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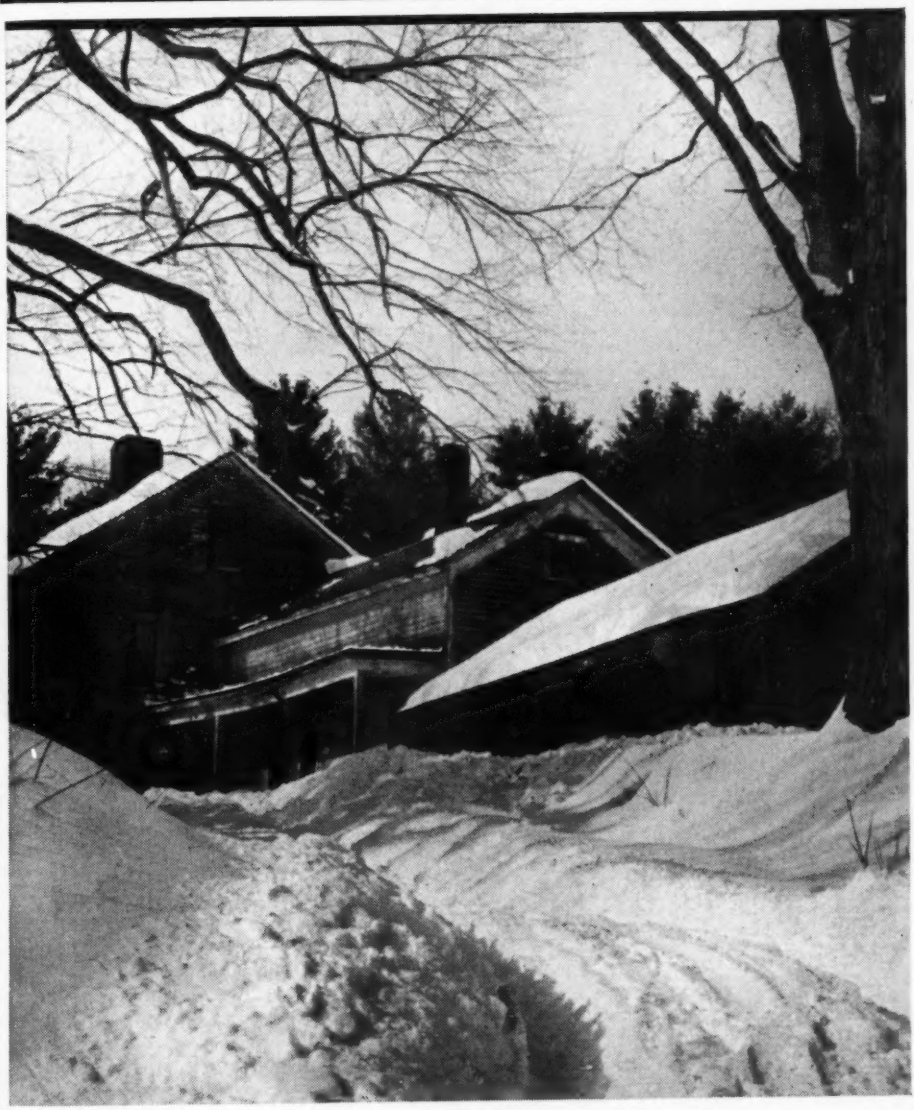

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The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVII NUMBER 10

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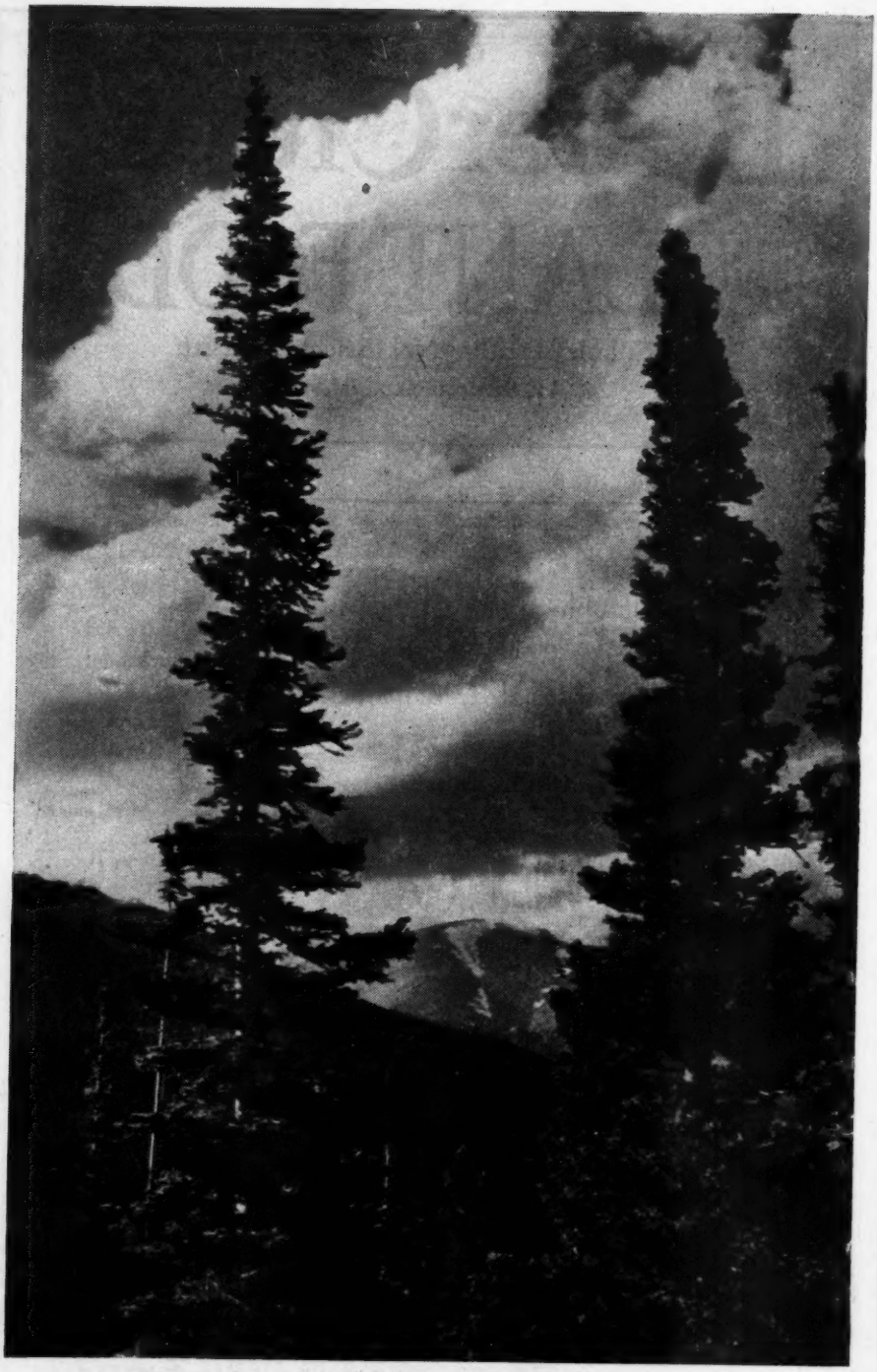

OUT WHERE THE CHRISTMAS TREES GROW TALL

Better Crops with PLANT FOOD

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VOL. XXVII WASHINGTON, D. C., DECEMBER, 1943 No. 10

Advocating a new . . .

Festive Philosophy

Jeff McDermid

GET YOUR votes dusted off, because I'm going to run for something next year. Maybe I don't know what to run for yet, but I'm sure of a platform to run on. Here it is: Less Hunger, Less Hatred; More Food, Less Fighting! And besides, it's a mighty good sort of holiday platform, if I do say it.

In this vein I shall inveigh against such deplorable things to point at with alarm as the following:

The racketeering in food by "black" markets and "yellow" consumers.

The bungling of food orders by busybodies.

Criminal neglect of the soil by some food producers and extreme trade rivalry between "competing" branches of the bread-basket brigade.

Normally, the chief obstacle to getting well organized for a vote-snaring campaign is this: If you run for some local office, too many home-folks know you too well, and if you seek higher and wider public thrones not enough people know you at all.

Hence the thing to do is to practice a little where it doesn't cost you anything for a hall or advertising space, and so that's my frank method of campaigning to date—merely seeing how many windmills I can start in motion by gusty philosophy. I'd rather dodge issues than eggs!

After attending divers conventions and discussion fiestas in this season of discontent, I am persuaded that our economic history in the making now won't stack up very nicely beside our military and naval history, when future generations read their text-books about this war.

My general impression is that part of

the folks are asleep about issues confronting us and the rest are on the warpath. If we side-step higher tax obligations and continue to hand out blank checks to spenders through private and public channels, and abandon all thought of economic discipline and national self control, we won't be like the army and navy—we'll just become a misled mob!

I ALWAYS find it convenient to drag in my wife's relations to point a moral or adorn a tale. Not that they are any worse than I am or better than you are, but they afford a handy whipping post which remains in the family so to speak and are thus within my legal rights of criticism.

Anyhow, my brother-in-law's wife comes up serenely from the nearest big metropolis and brags a lot about how long her ration points last because the considerate tradesman with whom she deals excuses her from tearing out coupons. She can get all the juicy ham and beef stew she wants minus any red tickets. Hubby can walk into any garage or gas house and get naphtha stove gas in a can to pour into his tank or have a fill-up on truck coupons.

Being all set for reform, and ready to begin, like charity, with the home-folks, I start right in to show my sister-in-law how misguided she is in her unpatriotic and heedless methods of food gobbling.

I am well prepared for the argument and quickly delve into my littered editorial sanctum to fetch forth a heap of official-looking circulars and background information to instill the fear of God and the Germans into all traitors who dabble in such petty infringments upon domestic discipline.

I start with the theory and sipirit of rationing, explaining carefully how even Merry England, wont to revel in all those luscious viands described with mouth-watering zest by Charles Dickens, from roast beef to Stilton cheese, began to tighten their belly-bands long before Pearl Harbor, and invented a dandy system of self-control based on a simple point system, making it easier to go hungry by spending your time figuring so as to forget.

I show her how England, China, Russia, Italy, and sundry other folks with dinners denied them have sought our plentiful shores in hopes that the lavishness of our larders might be shared with them, out of a common cause and for a common destiny, etc., etc.

I tell her of bursting bombs that ruin crops and upset more kitchen cabinets than executive ones, and point out the threat to future generations because of the large amount of malnutrition of parents and children. I show her that we are trying to hold back on our hoggishness even in the cornbelt, so as to provide the needful stores with which those who bear the brunt of the misery abroad may continue to act as a living shield for us who are safe from horrid night alarms.

Then for heavy artillery I drag out the BAE's cold-storage statistics and the outlook expectations, to prove to anybody but a numskull that farmers have risen with the lark and worked themselves and the hired men into a lather only to find the goals are kited up again and reserves are lower than ever.

"That can't be true," she says, "you see we and our neighbors laid in lots of canned goods when we first heard they was going to begin rationing stuff. If everybody had did that, Jeff, if everybody had been provident and forehanded like we was, without declaring what we had saved up which is nobody's business, why then you wouldn't hear so much griping. And, besides," she says, "what we deny ourselves and go without will most likely be sunk in the sea by some sub, and I don't propose to go hungry to feed the fish," she says. "All we are doing, Jeff," she says, "is to eat up what the foreigners wouldn't get anyhow."

"YA, that's the old American ruggedness asserting itself in the good old lazy fair way," chimes in my dumb-ox brother-in-law. "It ain't our fault if them Eyetalians can't live like

they uster on olives and macaroni. Let 'em live off what they stole from Albania and Abyssinia. I never read them pamphlets by bureaucrats who eat caviar in the Mayflower hotel and then fix things so a honest householder can't come off the swing shift and get hisself a square meal. Jeff, the quickest way to stop all these scraps in Europe and Asia would be to quit sendin' them grubstakes," he says. "And our armies are wastin' enough solid food to make

rationing here unnecessary," he winds up.

I sigh deeply and return my precious folders to their files. As he leaves us after the dessert is all consumed, he sums up his ideas with the phrase, "I'm all fed up!"

"Yes, I see you are," I rejoin in my best combative campaign manner. "Up to the neck on somebody else's red and blue coupons!" As he slams the door, I know that my first bout with democracy has been a flop. My slogan about "More Food, Less Fighting" has turned into just the opposite. But I resolve to dedicate myself to the mission anew and keep right on practising.

Thereupon I note with some candor that probably some injustice has been evident and no little duplicated effort and delay on the part of the so-called Washington bureaucrats. The remarks of my relatives and certain caustic comments heard elsewhere seem to deserve investigation, and maybe worse. Who could be in better shape to unravel the skein of kinks in our economics than myself, who spent three long years behind a desk, and behind time simultaneously, on the banks of the old Potomac during those months when we worried over a surplus rather than a scarcity.

If I am going to prepare myself for a public trust, no sounder method presents itself than to bust right into the midst of the mess to get wise to what's wanting. I can even sacrifice my precious moments thumping out counsel and good cheer to avid readers long enough to garner a few sheaves and help in the harvest at Grand Food Headquarters.

SO I clipped all the adverse news I could find about the way things are run wrong, and borrowed a Congressional Record, and hunted up and copied down many resolutions offered by Sons of Toil and Crusaders Against Control. I knew that they seldom read the Record down there, and that what was needed most is a closer tie with the taxpayers and the suffering citizenry. Altogether my grist filled a few tomes to tote, but I had faith that when a round-shouldered guy with nose glasses and a hefty warworn briefcase comes along he could gain admittance to almost any guarded federal building on his looks alone.

Thus armored and guaranteed by nature, plus my former passwords, sign language, and clock-watching habits gained by three years in the red-tape racket, I was confident of being able to bring about some degree of reform in Washington. I also brought some stout twine to unroll as I proceeded along vast corridors, having forgot the system of gold letter figures they put on the doors of the "extensible building."

(*Turn to page* 50)

Light-colored soils in southern Illinois, when untreated, produce a rather scant and discolored growth of corn and consequently a low yield (right). This low-yielding corn (grain and stalk) has a relatively high manganese content. On the other hand, when this land is treated with limestone, legumes, phosphorus, and potassium, the corn has a relatively high acre yield and a low manganese content (left).

Some Characteristics of Manganese

By H. J. Snider

Department of Agronomy, University of Illinois, Urbana, Illinois

MANGANESE is recognized as a minor element essential for the normal growth of plants. It has also been found to have an important function in the proper nutrition of farm livestock. It is reported to be especially required by chickens for bone development, and the development of embryos in eggs. Several ailments in farm animals which appear when manganese is deficient in the ration are reported (USDA Yearbook 1942).

Miller, in his very thorough text on plant physiology, says that manganese is universally distributed in plants, and cites many facts and also many suppositions regarding its function in plant development. There can be no doubt, from the evidence presented, that a deficiency of manganese in plants and in the rations of animals leads to abnormal development. Evidence of harmful effects of an excess of manganese is less definite, although there is some mention of this phase of the reaction of this element. Apparently, research has developed along the lines of determining deficiency effects rather than the effects of excess.

It is a generally accepted fact that available manganese becomes more abundant as soils become more acid and less productive. This effect is so pronounced in some soils that man-

TABLE 1.—AMOUNTS OF AVAILABLE MANGANESE AND NITROGEN IN SOILS AT VARIOUS TIMES DURING THE SEASON. SPARTA FIELD DATA.

Element	Soil pH	Pounds per acre				
		June	July	Sept.	Oct.	Nov.
Replaceable manganese	4.4	230	260	180	160	130
Nitrogen as nitrate	4.4	16	20	4	4	4
Replaceable manganese	6.2	40	40	30	30	20
Nitrogen as nitrate	6.2	120	70	20	12	4

Pounds per acre—Pounds in two million of soil.

ganese might be classed as a major element because of its relative abundance in available form, especially its greater availability during the growing season of late spring and early summer in some Illinois soils. On the Sparta Experiment Field (table 1), replaceable and soluble manganese was far more abundant in untreated soil—260 pounds an acre in July—than nitrate nitrogen—20 pounds an acre. It was also more abundant than replaceable potassium—100 pounds an acre—and soluble phosphorus—16 pounds an acre. These larger amounts of manganese in this soil were not far below the amounts of replaceable calcium—600 pounds an acre—and magnesium—340 pounds an acre.

The corn plant apparently takes up manganese in proportion as it is available in soils (tables 1 and 2). On the Sparta soil, where available manganese reached the high of 260 pounds an acre, the corn at dent stage contained 1.8 pounds an acre; and where manganese availability was controlled by liming (pH 6.2), the corn took up only 0.5 pounds an acre. The Sparta Experiment Field is located in southern Illinois, on a Cisne silt loam soil which is highly leached and has a rather impervious subsoil. This soil responds rather remarkably to soil treatment, as indicated by the results in table 2. When the acidity was corrected to pH 6.2 and the nitrogen, phosphorus, and potassium deficiencies also corrected (RL 0-20-20), the total plant growth was increased over four times—from 1,760 pounds up to 7,400 pounds an acre. Total nitrogen in the plant was increased over six times—12.8 pounds up to 80.2 pounds an acre. Phosphorus content was more than doubled—5.1 pounds up to 11.2 pounds. Potassium

TABLE 2.—CORN PLANT. DRY-MATTER YIELD AND CHEMICAL COMPOSITION AT DENT STAGE. SPARTA FIELD, SEPTEMBER 2, 1941.

Soil Treatment	Pounds per acre							
	DM	N	P	K	Ca	Mg	Fe	Mn
Untreated	1760	12.8	5.1	14.1	9.0	10.9	.4	1.8
RL 0–20–20	7400	80.2	11.2	59.8	32.6	23.0	.4	.5

DM—entire plant (stalk, cob, grain).
Pounds per acre—total elements in the corn plant.
R—crop residues (cornstalks, wheat straw, soybean straw, and legumes).
L—Limestone.
0-20-20—100 pounds for corn crop.

TABLE 3.—CORN PLANT. CHEMICAL COMPOSITION OF DIFFERENT PARTS. SPARTA FIELD DATA, SEPTEMBER 16, 1939.

Part of Plant	Percentage compositions					
	N	Fe	Mn	N	Fe	Mn
	Unlimed pH 4.4			Limed pH 6.2		
Leaf	.85	.011	.0630	1.57	.004	.0147
Node	.80	.016	.0116	1.78	.019	.0023
Internode	.57	.003	.0049	1.35	.005	.0012
Sheath	.52	.008	.0630	1.35	.004	.0169
Grain	1.46	.002	.0010	1.76	.001	.0002

was increased by over four times—14.1 pounds up to 59.8 pounds an acre.

In the presence of these large increases, the manganese content decreased by almost four times—1.8 pounds down to 0.5 pound an acre. On untreated soil (table 2), the nitrogen-manganese ratio in the corn plant (N:Mn) was 1:7, and on the treated soil (RL 0-20-20), the ratio was 1:160 (N:Mn). With these apparent deficiencies of other elements in this untreated soil, it is difficult to determine whether or not this concentration of manganese (1:7) was harmful to the corn plant. It seems doubtful that the corn plant would have such a high tolerance of this element without some harmful effects.

Determinations of iron and manganese in different parts of the corn plant (table 3) show that on the untreated Sparta soil the concentration of manganese was far greater than iron in the leaves and sheath, and slightly greater in the internode from unlimed soil. The concentration of iron was greater than manganese in the nodes and grain on both unlimed and limed soil, and slightly greater in the internode on the limed land.

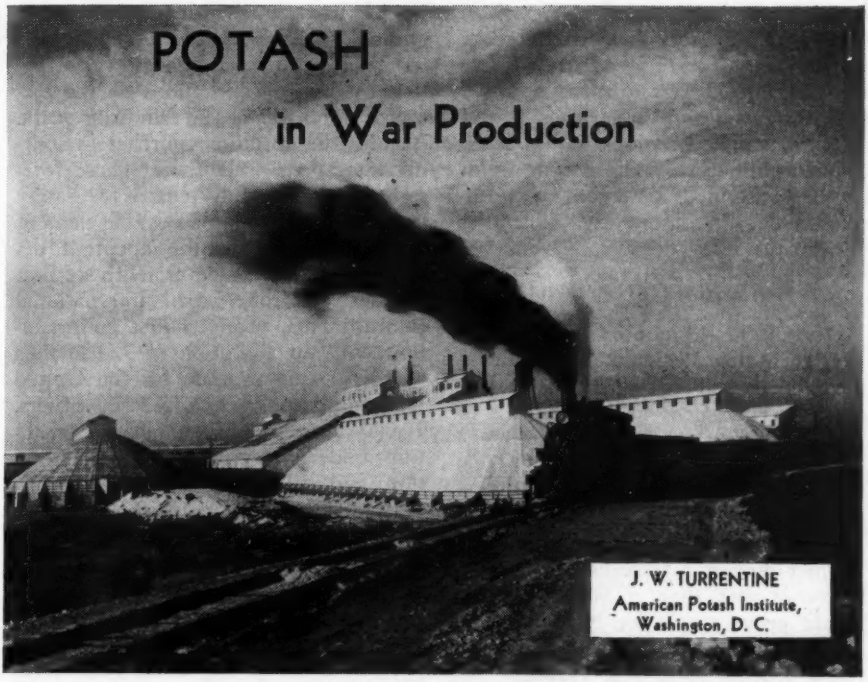
The extremely low percentage of manganese in corn grain, (table 3) from limed—.0002 per cent, and unlimed land—.0010 per cent, indicates that a deficiency might readily occur in animals or poultry if fed over a long period on a heavy corn-grain ration. On the other hand, if the livestock had access to leafy material such as corn blades (table 3), or soybean leaves (table 4), or grasses (table 5), this deficiency might easily be controlled.

Liming soils or raising the reaction from pH 4.4 to 6.2 on the Oblong Experiment Field altered both the nitrogen and manganese content of various

(*Turn to page* 46)

TABLE 4.—SOYBEAN PLANT. CHEMICAL COMPOSITION OF DIFFERENT PARTS AT MATURITY. OBLONG FIELD DATA.

Part of Plant	Percentage compositions					
	N	Fe	Mn	N	Fe	Mn
	Unlimed pH 4.2			Limed pH 6.0		
Roots	.90	.054	.0034	.94	.051	.0017
Stems	.96	.015	.0069	1.72	.007	.0017
Leaves green	1.88	.054	.0532	2.36	.033	.0081
Leaves dropped	1.06	.558	.0825	1.42	.527	.0192
Hulls	.97	.014	.0161	1.74	.012	.0028
Beans	5.72	.004	.0085	6.84	.004	.0029



Refinery of the United States Potash Company, Carlsbad, New Mexico.

While the supply situation on potash is bad enough to call for close scrutiny, it is not so bad as it has been represented, nor is it beyond repair. J. W. Turrentine, of the American Potash Institute, reviews for Chemical and Engineering News the present problems faced by the potash suppliers of the United States.

THE essentiality of potassium salts in American agricultural and chemical industries is a matter of general knowledge. With abundant supplies of a wide variety of materials readily at hand since the end of World War I and up to the present, there has been little occasion to analyze the nature of that essentiality. Now for the first time during that period we are confronted by a prospective deficiency in supply, which gives point to that analysis if we are to deal with the situation wisely and effectively.

One year ago it was my privilege to address this division on the subject "The Wartime Contribution of the American Potash Industry", describing the development of that industry and its success in expanding its output to keep ahead of the expanding demand—a normal expansion in demand resulting from the rapid spread of scientific practices in American agriculture, suddenly accelerated by the war emergency (with the termination of European potash importations) and by the food and fiber demands of the American people gainfully employed and with money to buy the food and clothing more nearly in the quantities required. Superimposed were the de-

mands of the largest army in American history and the best-fed army, I dare say, in world history, expanded further by Lend-Lease requisitions to help feed our Allies and the stricken people of war-devastated nations within reach of our munificence. The potash industry has sustained its record with increased output, despite the difficulties of wartime restrictions.

Allocations of Potash

During the 12-month period, April 1942 to March 1943, the American industry delivered 1,320,000 tons of potash salts equivalent to 700,000 tons of K_2O, a 20 per cent increase over the preceding 12 months, thus with 23,000 tons of muriate imported from Russia supplying the agricultural and chemical industries with the largest tonnage in their history. According to all estimates of less than a year ago, this would prove ample for North American requirements including Canada, Cuba, Puerto Rico, and Hawaii. As formerly, the major part of this tonnage was in the form of highly refined potassium chloride, known in the fertilizer trade as 60 per cent muriate.

This performance was no accident, but was the result of careful planning and remarkably accurate forecasting of North American requirements. In view of restrictions through priorities on materials of construction and repair and the ever-mounting scarcity of skilled labor, the development of surplus production capacity beyond the absolute needs of the day and the predictable early future was definitely against public policy as dictated by federal war agencies. The objective, therefore, was a margin between supply and demand designed as insurance against the unhappy consequences of interrupted production. It did not and could not contemplate demands extraneous to the North American requirements on which its operations were based.

The allocation of this tonnage among buyers was undertaken as a function of the War Production Board early in 1943. First, the chemical industry was granted priority. With respect to the fertilizer industry, the policy was established of basing allocations on the record of purchases of the two prior years. Among the would-be purchasers seeking allocations were those whose foresight prompted full regard for safety margins, thus adding a possible element of the fictitious to the apparent demand. Others, however, with authority derived from broad international commitments, received first consideration with an allocation of 72,000 tons of 60 per cent muriate for the United Kingdom under Lend-Lease; others, 10,000 tons for Puerto Rico agriculture undergoing attempted rehabilitation, and still others. These prior allocations completely wiped out the safety margin and for the first time brought about a real deficit in supply. The Agricultural Adjustment Administration bidding for 50,000 tons K_2O for its improved pasture and legume programs, withdrew entirely in favor of cash crop requirements. Allocations announced on the basis of the 10-month, so-called "contract season" instead of a full year's purchase further accentuated the deficit.

The War Production Board is allocating this 700,000 tons of K_2O for the 1943-44 delivery period as follows:

AGRICULTURAL	
36,000	United Kingdom
35,000	Canada
4,000	Latin American and others
540,000	United States, Puerto Rico, and Hawaii
CHEMICAL	
85,000	United States (includes 7,500 tons of K_2O equivalent as caustic, also allocated for export to United Kingdom)

This represents new allocations to the United Kingdom of 36,000 tons of K_2O for agricultural use and 7,500 tons for chemical use, a total of 43,500 tons of K_2O or 72,000 tons of 60 per cent muriate, withheld for export under Lend-Lease if the equivalent cannot be obtained from Palestine, Spain, and Russia. The allocation to chemical industries of 85,000 tons of K_2O represents an increase of 17,700 tons over

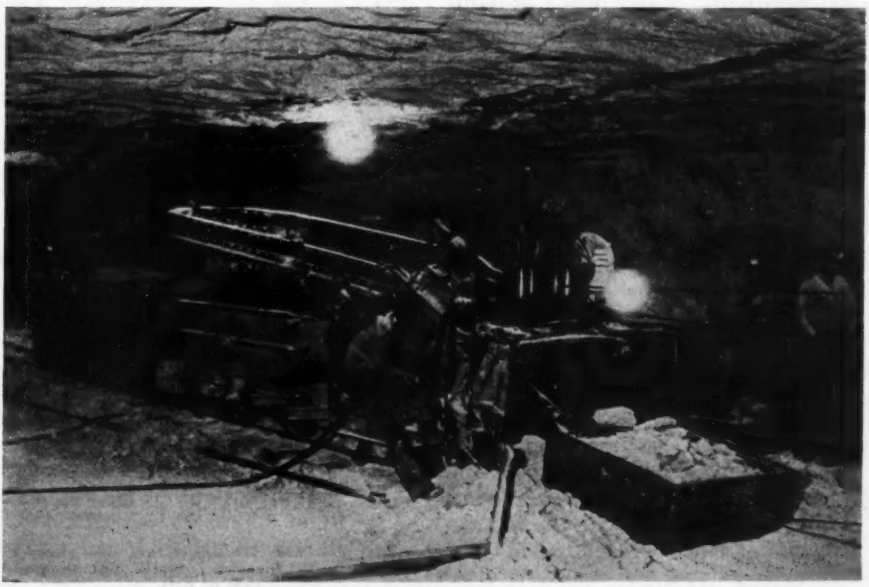
the 67,300 tons of K_2O delivered to those industries during June to May, 1942-43.

Approximately 88 per cent or 476,730 tons of the remaining 540,000 tons of K_2O for agricultural use in the United States, Puerto Rico, and Hawaii has been allocated to the several individual fertilizer-mixing industries for delivery to them during the 10-month period, June through March 1943-44 (period 2, the so-called "contract season"). These allocations are based on corresponding deliveries during 10-month periods of 1941-43.

The remaining 12 per cent is to be allocated for delivery during April and May 1944 (period 3, the so-called "spot season"). The War Production Board conservatively advises that this supplemental allocation be estimated at 10 per cent of that allocated for the 10-month period, although it is confidently expected that it will be nearer 15 per cent. But on the 10 per cent basis, the 12-month allocations, June through May 1943-44, in the several categories of potash salts as compared to deliveries of the two preceding years, are detailed in Table I.

Allocations so far announced by the War Production Board are only for the 10-month period, and additional quantities remain to be assigned. This has not always been understood and may account for exaggerated statements as to the potash shortage. This tabulation indicates that the shortage for 1943-44 may amount to as much as 60,000 tons of K_2O (approximately 10 per cent) as compared to 1942-43, but an increase of 9,200 tons as compared to 1941-42. It is obvious that the most effective way to improve the supply situation is to provide British requests from less restricted sources, for the stringency in supply arises principally from the diversion of 60 per cent muriate from our food program. This raises the question, as yet unanswered, whether that diverted tonnage would better serve the joint war effort if used on American soils where potash requirements and responses are both high.

Nor are we yet at the end of our rope. All American producers are assiduous in seeking increased efficiency; one is now surveying plans for a substantial increase in refining capacity; another is exploring by core drilling the newly discovered potash deposit in



Subsurface view of mines of the United States Potash Company, Carlsbad, New Mexico.

TABLE I.—POTASH ALLOCATION FOR AGRICULTURAL USE IN THE UNITED STATES, PUERTO RICO, AND HAWAII FOR 1943–44 AND DELIVERIES FOR 1942–43 AND 1941–42

Salts	1943–44		1942–43		1941–42	
	10 mos.	12 mos.	10 mos.	12 mos.	10 mos.	12 mos.
	Tons K_2O		*Tons K_2O*		*Tons K_2O*	
60% muriate	349,604	388,449	414,943	461,047	369,044	410,049
50% muriate	40,142	44,602	33,162	36,847	29,275	32,528
25% manure salts	42,200	46,889	43,264	48,071	33,266	36,962
Sulfate (50%)	34,829	38,699	32,981	36,645	30,723	34,137
S. P. M. (22%)	9,955	11,061	6,591	7,324	6,228	6,920
Total	476,730	529,700	530,941	589,934	468,536	520,596

eastern Utah. However, to develop a new mine and install a refinery two years' time might be required, providing no immediate relief from the present stringency. Last winter we imported 23,000 tons of 60 per cent muriate from Russia and now have 20,000 under contract with option on an additional 20,000 tons. The process of increasing supplies is still being pursued, although its outcome cannot be predicted.

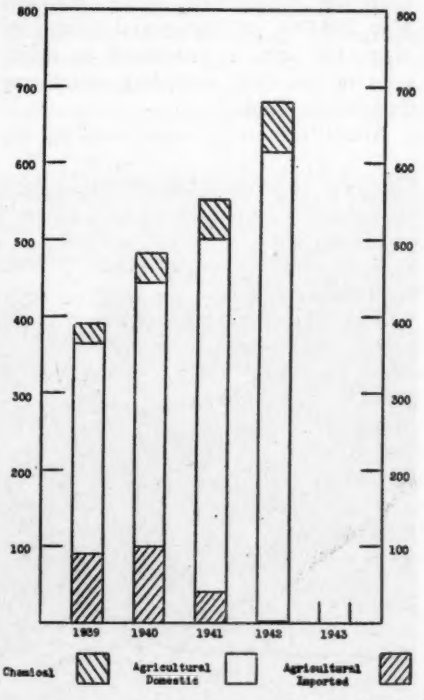
Significance of Potash Deficit

So, while the supply situation is bad enough to call for close scrutiny, it is not so bad as it has been represented, nor is it beyond repair. What is the real significance of this deficit in terms of production of essential crops and what is its bearing on our production program?

First, it is necessary to define the dimensions of our deficit. There is no reliable measure of the amount of potash that would now be consumed if the supply were unlimited. In the words of Firman E. Bear, of New Jersey, quoted from a private communication: "We have just begun to recognize the tremendous significance of potash in our agricultural economy." Truog, of Wisconsin, states: "Our tremendous production of legumes . . . is calling for more and more potash and unless we get these additional amounts, it will be difficult to step up or even continue our present production of legumes which are the foundation of our whole agriculture in Wisconsin."

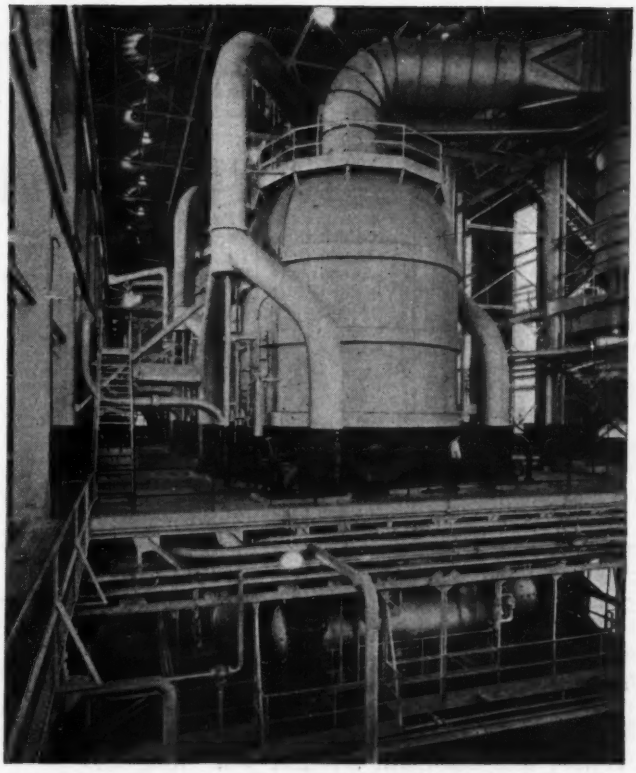
The War Production Board states that "the fertilizer industry requested 940,000 tons of high-grade muriate". This is equivalent to 564,000 tons of K_2O, 176,000 tons more than the 388,000 tons of that preferred grade allocated to U. S. agriculture, but only 34,000 tons more than the total of 530,000 tons of all grades to be allocated.

Somewhere between these two extremes lies the immediate purchaser demand, influenced, however, by reluc-



Potash deliveries for agriculture and chemical use in North America. Scaled per thousand tons of K_2O.

tance to buy the more expensive lower grades and by consideration of stockpile safety margins. The War Food Administration estimates our 1944 potash requirements at 877,000 tons of K_2O, if we are "to obtain capacity agricultural production". Canada, asking for 50,000 tons of K_2O was allocated 35,000 tons, which is 5,000 tons below the 40,000 tons used last year.



Evaporators at potash refinery, Trona, California.

The expansion called for in crop production connotes a corresponding expansion in potash consumption, for it is well demonstrated that the surest, quickest, and cheapest method of increasing crop production is by means of adequate fertilization—fertilization with mixtures of proper ratios, at optimum rates of application, most effectively placed. This fact takes on added significance today when farm labor is scarce, wages are high, and gasoline and rubber for farm machinery are restricted to the most essential uses.

In emphasizing this fundamental principle, Scarseth estimates that his state of Indiana "alone has the potentiality of producing 85,000,000 more bushels of corn and 32,000,000 more bushels of wheat, oats, and soybeans and 800,000 more tons of tomatoes annually" all without plowing up a single additional acre. To "supply maximum soil fertility for highest possible production of crops", he arrives at the figure of 375,000 tons of K_2O as contrasted with 30,600 tons used in 1941. On such a basis, the Indiana potash deficit alone is some 340,000 tons of K_2O.

Yoder, of Ohio, adds his support:

Increasing acre yields—that is, increasing production by vertical expansion—is a sound, fundamental method of increasing production of both food and feed crops; it is conserving of land, labor, and machinery. The importance of commercial fertilizers in effecting increased acre production has been carefully evaluated during four decades of research by the State Agricultural Experiment Station. The validity of the results obtained has been thoroughly tested and verified by tens of thousands of Ohio farmers. This wealth of factual information must be

TABLE II.—SIGNIFICANCE OF ADDITIONAL POTASH IN AMERICAN FOOD PROGRAM

Crop	State	Present Area in Crop	Additional K_2O Needed		Increased Yield Produced	Total Value of Crops	Value of 1 Ton, 60% Muriate in Crop Equivalent
			Per Acre	Total			
		Acres	*Lbs.*	*Tons*	*Bushels*		
Potatoes	Maine	200,000	80	8,000	2,400,000	$2,592,000	$324
	N. C.	100,000	60	3,000	1,200,000	1,524,000	508
Peanuts	N. C.	300,000	15	2,300	10,100,000 lbs. nuts	545,400	237
Sweet potatoes	N. C.	85,000	40	1,700	1,700,000	2,176,000	1,280
					Pounds		
Cotton	N. C.	850,000	20	8,500	24,650,000 lint	4,856,050	
					9,860,000 oil	1,257,150	Av. 758
					17,255,000 meal	333,021	
Cotton	S. C.	1,100,000	15	8,200	46,200,000 lint	9,240,000	
					18,480,000 oil	2,356,200	Av. 1,490
					32,340,000 meal	624,162	
					Bushels		
Corn	Indiana	4,300,000	30	64,500	43,000,000	37,410,000	580
Wheat	Indiana	1,100,000	20	11,000	3,300,000	4,356,000	396
Tomatoes	Indiana	50,000	30	800	400,000,000 lbs.	2,680,000	3,350
Hay	Indiana	1,000,000	30	15,000	500,000 tons	7,720,000	514

utilized if production goals are to be approached.

The following gains may be expected on the basis of Ohio experience: (*a*) 114,000 tons additional fertilizer will give 17,500,000 bushels additional corn production at a fertilizer cost of 25 cents per bushel; (*b*) 62,000 tons additional fertilizer applied on small grains seeded to hay crops will give 270,000 tons additional of hay, 2,300,000 additional bushels of wheat, and 1,130,000 additional bushels of oats (nearly $6,000,000 worth of feed and food products at a fertilizer cost of $2,000,000). The residual effects of the additional fertilizer will give an extra million bushels of soybeans without acreage expansion. These prospective gains illustrate vertical expansion.

Thomas, of Maryland, estimates that if the 1,570,000 acres which may be best utilized for crop production in his State were fertilized with grades designed for maximum crop returns at rates providing optimum plant food requirements, some 297,000 tons of fertilizer would be required, an increase of 160,000 tons over the 137,000 tons usually applied, to yield probable increases of 23 per cent for corn, 47 per cent for wheat, 16 per cent for soybeans, 50 per cent for pastures, 23 per cent for potatoes, 20 per cent for tomatoes, etc.

Truog of Wisconsin estimates the potash needs of his State at 50,000 to 100,000 tons against the 10,000 tons allocated. Sturgis of Louisiana estimates the needs of his State at 50,000 tons against the 10,000 now used.

Add these to analogous figures from the many other states where potash use falls short of the optimum, as demonstrated by the respective state experiment stations, and there results a total of such dimensions as to show the essentiality of extreme wisdom in potash allocation and how far we have to go before our soils are brought up to their maximum productivity.

But even if we had such a potash tonnage at hand, we still could not attain these maximum yields, for, as Bauer and Scarseth are careful to emphasize and as we all know, potash to be used efficiently must be used in the proper ratio to nitrogen and phosphorus, which again for the country as

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Yearly Crops from Farm Woodlands

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

USUALLY a farmer thinks of his woodland as a permanent investment. It will give him his fuel and a few fence posts; its edge will shelter the cows; and eventually, but probably not in his lifetime, someone will harvest a 60-year-old crop and leave the land denuded. He doesn't want to see it.

Only recently and in certain places have farmers come to think of their woodlands somewhat as they do of their fields—as a producing part of the farm, to be considered yearly in farm-management plans, and to be cropped judiciously for an annual small income that will not drain the forest, nor shorten its life, nor ruin its appearance. In fact, it may be just the opposite on all three counts.

In upstate New York in Otsego County, they are learning how to do just this thing. They are gradually fitting the woods work into the seasons when they or their hands might not have enough to do to make the best use of their time, and they find that they can do this work efficiently and with profit.

Long ago the forests were the chief source of cash to the settlers around Cooperstown, but with the well-known

The Forest Service has helped to select the right trees.

evolving enonomy of an agricultural area, they had ceased to bring the farmers money from year to year. During the depression these farmers were hard put to it, and their anxious thoughts turned toward the woods as they groped for a way out of their dilemma.

In 1935, with a Congressional appropriation the Forest Service set up at Cooperstown a substation of the Northeastern Forest Experiment Station. It was to establish the technical basis for a cooperative forest-management and forest-use program for the farm woodlands thereabouts as a demonstration of possibilities.

waste, and to stabilize the marketing of their forest products.

By combining comparatively small quantities of forest materials from the farms the Cooperative will accumulate a volume that will allow efficient manufacturing and marketing. The Forest Service, while doing other vigorous educational work, has so far done the actual timber selection.

Next, the farm part of the enterprise had to be integrated with the other farm work in such a way that the usual dairying, poultry, and small-crop farming wouldn't suffer—nor the farm workers either. Fortunately the woods

Cooperation has brought a good local outlet.

To do their part, the citizens then organized the Otsego Forest Products Cooperative Association, and the F.S.A. granted it a loan to build and operate a small modern processing plant. The Association now has more than 600 members; the plant is finished and operating.

Members are now out to achieve their purposes—to encourage better care and increased productivity of the woodlands and the orderly and efficient marketing of the products through cooperation, to eliminate speculation and

are not so perishable as most crops and do not demand attention on any one month, week, day, or hour, though of course seasons must be observed and market conditions may vary. Much of the woods work can be done in late fall and winter.

Then the woods must be protected better than in the past—protected from grazing animals, disease, insects, and fires. This may mean some expense, especially for fences. Some careful weeding out of undesirable trees and

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What's in that Fertilizer Bag?[1]

By Vincent Sauchelli, Agronomist

The Davison Chemical Corporation, Baltimore, Maryland

"MR. CHAIRMAN, the last speaker just explained that the 3-12-12 on a fertilizer bag means 3% nitrogen, 12% phosphoric acid, and 12% potash. These figures add up to only 27%. But it seems to me that fertilizer should contain about 100% of plant food. What's the rest of it?"

This question was asked during a farmers' meeting. It was prompted by a remark by a speaker that "the figures on a fertilizer bag, as 3-12-12, indicate the guaranteed percentages of the three main plant nutrients, nitrogen, phosphoric acid, and potash, and are always in the same sequence." Similar questions are often heard wherever farmers gather to discuss fertilizer. The questioner seems puzzled and gropes for a logical answer. A satisfactory answer can be given, of course. However, for the questioner to understand, it is necessary that he have some knowledge of chemistry and of the chemical composition of fertilizer materials. An attempt will be made in this paper to give such an answer. Starting with first things first, we shall first explain briefly the standard trade terms which make up the chemical jargon used by chemist, fertilizer manufacturer, and agricultural worker. In this way we shall all speak the same language and thereby reduce the chances for misunderstanding.

Most farmers are curious about the fertilizer materials used in preparing the mixed fertilizers they buy. They all should be. It would help them and manufacturers who honestly try to give full value to their customers if all farmers and others were more familiar with the facts.

The development, growth, and health of plants depend on about 16 chemical elements, which, for convenience, are grouped as follows:

Primary: Nitrogen (N), phosphorus (P), potassium (K).

Secondary: Calcium (Ca), magnesium (Mg), sulphur (S), boron (B).

Trace or Minor: Manganese (Mn), iron (Fe), zinc (Zn), copper (Cu), sodium (Na), silicon (Si), chlorine (Cl), cobalt (Co), fluorine (F).

(The symbol in the parenthesis is the chemical shorthand way of designating the element).

Plant-food Content of Fertilizers

It is surprising to realize how many are the misconceptions about fertilizers. Most of them undoubtedly are due to a lack of proper understanding of the chemistry involved. Fertilizers are no longer the simple mixtures of the primitive period of the industry. Much chemical and technical knowledge and experience are required to make the economical, perfect blend of materials which characterizes the modern product. Today's fertilizer materials are concentrated plant foods and their use leaves very little room for the cheap inert "fillers" which formerly were used freely. For example, a generation or so ago the maximum plant-food content of a fertilizer was about 12 to 14%. Today many grades of fertilizers have as high as 45 to 50% plant food, and 20% is considered a fairly good minimum.

[1] The first of two articles.

To prepare such high analysis "goods" requires the use of concentrated plant-food materials plus chemical knowledge, experience, and engineering.

A common misconception that needs correction is that the farmer is obliged to buy fertilizer materials that are low in total plant food and wastefully high in inert carrier or filler. In support of this some cite the fact that a 100-pound bag of nitrate of soda provides only 16 pounds of nitrogen; that 100 pounds of normal superphosphate contain only 16 to 20% of phosphoric acid (P_2O_5); and that 100 pounds of cottonseed meal contain only 6 to 8 pounds of nitrogen. These are merely examples of many other similar cases of materials having a low total plant-food content. Why, it is asked, do farmers have to buy such low-grade materials and pay a lot of handling and transportation charges on unnecessary carrier? This type of question is understandable, but also betrays a lack of knowledge in him who asks it. As well complain about the gross wastefulness of throwing away coffee grounds or spent tea leaves. It is in the nature of things and cannot be avoided.

Materials must be in a form that are easy to handle and find in abundance in the market place. Farmers know this. They know when they sell their "4% milk" that the largest part (85%) of the precious fluid is water which is present in the milk as Nature makes it. Farmers buy feeds high in protein such as "60% tankage." This type of feed actually contains only about 9.5% nitrogen. The chemist does not determine the protein content. He analyzes the product for its nitrogen content and multiplies the latter by the factor 6.25 to get a figure which is conventionally reported as protein. It is all legal and correct. The point being made here is that a 60% protein feed contains about three-fifths the nitrogen carried by nitrate of soda. By comparison sulfate of ammonia with 20% nitrogen should be considered a concentrated product.

Far-fetched, you say? No, not exactly. These references to the coffee grounds, milk, and feed materials are made solely to illustrate the fact known to everyone, namely, that in our daily life we must accept many commodities which have an inseparable amount of so-called carrier in order to get a relatively small amount of the essential nutrient. In other words, it is not always possible nor practicable to get the nutrient elements in 100% pure form.

Composition of Plants

Plants are largely made up of sugars, starches, fats, and cellulose which comprise the carbohydrate group. These substances are composed largely of carbon (C), hydrogen (H), and oxygen (O), which in turn are derived from carbon dioxide gas (CO_2), water (H_2O), and oxygen (O) from the air above and below ground.

Burn a plant and about 95% of its weight disappears. Why? The carbon, hydrogen, nitrogen, and oxygen of the tissues volatilize into the air in the form of carbon dioxide, water vapor, and ammonia (NH_3). Chemical analysis has shown that the 5% mineral residue or ash may contain as many as 64 different chemical elements, some being present merely in trace amounts. Some contend all these elements are needed for normal growth. However, for this discussion, it is best we confine ourselves to the 16 principal elements previously mentioned which are recognized as of primary importance in soil fertility and crop production.

Fertilizers are applied to soils known or suspected to be insufficiently supplied with plant food. It is the fertilizer manufacturer's job to search for and obtain materials that contain these important plant nutrients in a form easy and safe to handle and readily available to plants and at the same time, sell them at a price within the reach of farmers.

According to L. L. Van Slyke's definition, "A fertilizer is any substance which, when added to a soil, will, under favorable conditions, produce a better growth of crops, whether through direct or indirect action on the crops or on

the properties of the soil." The same authority defined "plant food" as a "substance which supplies any constituent necessary for the nourishment of plants and in a form suitable to promote their development or capable of being changed by natural processes into such a form." It is a little confusing at times that we do not all use the same terms to describe fertilizers and fertilizer materials. Some will use the words "manure" and "fertilizers" interchangeably; or "fertilizer," "phosphate," and "guano" to mean the same thing. Although it may not be technically correct, the tendency among the trade at the present time is to use the term "plant food" almost exclusively. Before it can be utilized as a plant food or nutrient, a substance must first be dissolved in the soil solution and then absorbed into the plant.

We cannot use pure nitrogen or phosphorus or potassium in fertilizers. Nitrogen is a gas. In fact, 80% of the air we breathe is nitrogen. Neither humans nor animals nor crop plants can utilize nitrogen as such. Legumes, we say, can take nitrogen from the air. Actually, it is not the legume plant but microscopic bacteria located in the nodules on the legume roots which have this ability.

Phosphorus, as such, is a yellow, waxlike substance which flashes into flame when exposed to the air. The chemist keeps it under water to prevent it catching fire. The element phosphorus is toxic in some forms and could not be used as such in fertilizers.

Pure, metallic potassium is a soft, bright substance having the appearance of lead. It oxidizes very quickly in the air, and in the presence of water combines to form caustic potash, which, as is commonly known, is highly toxic to plants. It must be kept under oil to prevent its oxidation.

Therefore, since the pure elements cannot be used, we are compelled to take the "carrier" portion along with the plant nutrients. Three groups comprise the important fertilizer materials of commerce—the nitrogens or ammoniates, the phosphates, and the potash materials.

The Nitrogenous Materials

The chemical symbol for nitrogen is the letter N. It is a relatively inert element; that is, it does not readily take part in chemical reactions. Through the agency of bacteria, plants, animals, or industrial chemical processes, it is changed into chemical compounds which readily become available sources of nitrogenous plant food. Plants cannot absorb nitrogen as such; they utilize it in the form of ammonia, which is designated by the chemical symbol "NH_3," or as nitrate, which in chemical shorthand is "NO_3." NH_3 means one part nitrogen is combined with three parts of hydrogen. NO_3 means one part nitrogen is chemically combined with three parts of oxygen.

The chief ammoniates or nitrogenous materials are grouped as organic and inorganic, depending on source or form.

Organic ammoniates are derived from vegetable or animal sources. In this group the nitrogen is not water soluble; therefore, not available to plant growth until it has been made so by either chemical or bacterial action or by both. Animal sources furnish tankage, hoof meal, fish waste, and guanos. Vegetable sources provide cottonseed meal, castor pomace, soybean meal, and other vegetable meals.

Inorganic or mineral nitrogens are derived from mineral deposits such as nitrate of soda and nitrate of soda and potash; from industrial sources, such as byproduct sulphate of ammonia, nitrate of lime, ammonia solutions, nitrate of soda, nitrate of potash, ammonium nitrate, cyanamid, and uramon. Some authorities classify cyanamid and uramon (which is a commercial form of urea) as "organic ammoniates."

Plants do not distinguish between one source or another; that is to say, it seems to make no difference whether the source is animal, vegetable, or industrial-synthetic, the element nitrogen itself ultimately is the same regardless.

"Animal," "vegetable," "natural," "synthetic" are merely convenient classifications. The hungry plant wants and requires only the plain, simple, everyday kind of nitrogen. This may be confusing, at first; but it means that when, for example, dried blood or cottonseed meal is decomposed in the soil and its nitrogen is released as ammonia, that ammonia so derived is identical with the ammonia which is derived from sulfate of ammonia or ammoniated phosphate.

Practical considerations will and should influence the farmer's choice. Organic nitrogenous materials must be completely decomposed in the soil before they can release nitrogen to the soil solution. This takes time. They are, therefore, slowly available. Farmers have frequently found it desirable to use some economical organic materials for a part of the nitrogen required. The cheapest sources are manure, green cover crops, and similar vegetation produced on the farm.

Nitrate nitrogen is the quickest acting form of nitrogen. Its quick solubility may be a drawback, especially on sandy soils, since nitrates have a tendency to leach easily in periods of heavy rainfall. Tobacco growers in Maryland, North Carolina, and other states who plant on sandy soils have often observed serious nitrogen deficiency symptoms following heavy rains. The ammonia form of nitrogen, present in or quickly formed from such materials as

PRINCIPAL COMMERCIAL NITROGENOUS MATERIALS WITH THEIR NITROGEN CONTENT

Material	Organic Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Amide Nitrogen
	Per cent	Per cent	Per cent	Per cent
INORGANIC				
Sulfate of ammonia		19.5–21.0		
Nitrate of soda			15.4–16.5	
Nitrate of potash			12.6–14.0	
Nitrate of soda-potash			13.7–15.5	
Calcium cyanamid				21.0–23.7
Urea				46.0
Uramon				42.0
Ammonium sulfate-nitrate		19.5	6.5	
Ammonium nitrate		15.0–17.0	15.0–17.0	
Cal-Nitro		7.8–12.5	7.8–12.5	
Ammoniated phosphates		3.0–16.8		
Calurea			6.8	27.2
Calcium nitrate			13.0–15.5	
Anhydrous liquid ammonia		82.2		
Urea-ammonia liquor B		25.2		20.1
ORGANIC				
Animal tankage	5.5–10.0			
Dried blood	6.0–14.0			
Fish scrap, dried	6.5–10.0			
Cottonseed meal	5.3– 7.5			
Castor pomace	4.0– 7.0			
Process tankages	6.5–10.0			
Sewage sludge, activated	4.9– 7.5			
Fish tankage	6.5–10.0			
Garbage tankage	3.3			
Cocoa shell meal	2.5			
Ground bone & bone meals	0.7– 5.3			
Tobacco stems	1.3– 1.6			
Linseed meal	5.0– 5.5			
Soybean meal	7.0– 8.0			
Guano (natural)	0.5–12.0			

ammonium sulfate, uramon, calurea, and cyanamid, does not leach so readily as the nitrate form. Because of this property and the more favorable prices at which they usually sell, these materials are becoming the dominant sources of nitrogen in fertilizers.

Phosphatic Carriers

Phosphatic fertilizer materials come from three main sources—bones, rock, deposits, and some special iron ores. Bone and the rock phosphates contain insoluble or tri-calcium phosphate.

Principal Phosphatic Fertilizer Materials and Their Phosphoric Acid (P_2O_5) Content

Material	Available Phosphoric Acid	Total Phosphoric Acid
	Per cent	Per cent
INORGANIC		
Superphosphate	16.0–22.0	.....
Double superphosphate (treble, triple)	40.0–50.0	.....
Ammoniated phosphates	16.0–52.6	.....
Precipitated phosphate	37.0–42.0	.....
Basic slag[1]	5.0–20.0	.....
Calcium metaphosphate	60.0–62.0	.....
Ground phosphate rock and other phosphatic mineral products	.....	12.0–35.0
ORGANIC		
Sewage sludge	2.0– 3.6	.....
Bonemeal & ground bone	.....	17.0–30.0
Animal tankage	.....	5.0–18.0
Garbage tankage	.....	4.5
Fish scrap, dried	.....	5.0– 8.0

[1]Basic slag produced in the U. S. A. is sold on the basis of total phosphoric acid, which usually is about 8%.

Just 100 years ago Liebig in Germany and Lawes in England first described chemical methods for making the relatively insoluble phosphate carriers more soluble by treating them with sulphuric acid. In the process the three-lime phosphate is converted partly to the two-lime and to the one-lime phosphates, which are readily soluble in soil water and thus become immediately available. Lawes called the end product of the acidulation "superphosphate." That name has been used ever since.

The chemical symbol for phosphorus is the letter "P", and for phosphoric acid the fertilizer trade uses the symbol "P_2O_5." This symbol means that two parts of phosphorus (P) are combined with five parts of oxygen (O). In referring to it we say "P two O five."

The words "phosphates," "phosphoric acid," and "phosphorus" are used interchangeably. This is incorrect and may cause confusion. The more common practice is to refer to the phosphorus in the carrier as phosphoric acid and to denote it by the symbol P_2O_5. Fertilizers may contain one or more of the following chemical forms of the calcium compounds of phosphoric acid:

(1) Mono-calcium phosphate or $CaH_4(PO_4)_2$ in which one unit of lime and two units of water are combined with one unit of phosphoric acid. This form is soluble in water and readily available to growing crops. About 80% of the phosphoric acid (P_2O_5) in 20% superphosphate is in this form, which is responsible for the popularity of superphosphate for fertilizer purposes.

(2) Di-calcium phosphate or $Ca_2H_2(PO_4)_2$ in which form two units of lime and one unit of water are combined with one unit of phosphoric acid. This

form of phosphate is classed as available to plants, although it is not soluble in pure water. It is soluble in weak acids. This form is also referred to as "reverted" or "precipitated."

(3) Tri-calcium phosphate or $Ca_3(PO_4)_2$ in which one unit of phosphoric acid is combined with three units of lime. It is the kind of phosphate found in bones and also called "bone phosphate of lime" or B.P.L. This compound is insolube in water. It cannot be used readily by growing crops. Under certain conditions in the soil, it eventually breaks down by chemical action to a form that may be used by plants.

Rock phosphate has the chemical formula $Ca_3(PO_4)_2.CaF_2$ and is recognized to be more or less slowly available to crops, depending on fineness of grinding, soil conditions, and crop being grown.

The availability of a material is determined largely by its chemical quality. We speak of "available phosphoric acid" to mean that part of the total phosphoric acid which is quickly released into the soil solution. The chemist uses a more exact definition which specifies solubility in water and in a specially prepared chemical solution under defined conditions. We are not concerned with that here. We merely give the practical everyday understanding of the word as it is ordinarily used in the trade.

Revert means literally to turn back. We say phosphoric acid is reverted when, under certain conditions in the soil or through chemical action outside the soil, the water-soluble portion of phosphoric acid is changed to less soluble form. Di-calcium phosphate is also known as reverted phosphoric acid and is to be regarded as an efficient form of phosphoric acid for plant-food purposes. Agronomic research has abundantly proved that reverted phosphoric acid is the equal in crop-producing value to water-soluble phosphoric acid.

"Insoluble" phosphoric acid includes that portion of the total which will not go into solution quickly or which, as a result of chemical or bacterial action in the soil, becomes available only after a relatively long period of time. For example, we speak of "insoluble phosphoric acid;" "insoluble organic matter."

Superphosphate is not "acid"; it is a neutral compound. It does not leave an acid residue in the soil. The description "acid phosphate" was used in our country until quite recently to distinguish it from rock phosphate. Because the phrase was misunderstood and misleading the trade decided to use the word "superphosphate" exclusively. As a matter of fact, the continued use of superphosphate helps to improve soil conditions by throwing toxic compounds out of solution. Aluminum is a soil element known to be toxic to plant life which may become soluble in an acid soil. Superphosphate has the ability of combining with aluminum to form a difficultly soluble aluminum-phosphate compound harmless to plants.

Superphosphate is the most important commercial source of phosphorus for plant-food purposes. It ranks first in the fertilizer industry in quantity consumed. The industry uses it principally in formulating mixed fertilizers. Farmers also use it in large quantities for direct application, chiefly on grassland, but also on wheat and other crops where the soil may be adequately supplied with nitrogen and potash, and for reinforcing stable manure.

Superphosphate is made by causing sulfuric acid to react with pulverized rock phosphate, in about equal proportions by weight. The product resulting from this acidulation is called ordinary or normal "superphosphate," and is a mixture comprising mono-calcium phosphate and calcium sulfate (also known as gypsum) in almost equal proportions. This product is also called "den" or ordinary superphosphate, because the reaction between ground rock and acid takes place in a den, a space usually about 20 feet square and 20 feet high and holding from 100 to 300 tons. Ordinary superphosphate usually contains from 18 to 20% available phosphoric

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There was grass on this upland pasture in Lancaster County, Pennsylvania, after it received a liberal application of complete fertilizer.

Commercial Fertilizers for Livestock Farms

By S. D. Gray

Washington, D. C.

AGRICULTURAL production throughout the United States has undergone drastic changes during the past two years. Even further changes are in prospect for 1944. The farms of the nation are rapidly approaching 100% production capacity if measured by the number of acres utilized. Even greater capacity may be expected in 1944 if these acres are utilized more intensively and adjusted to meet the tremendous wartime demands. This means much higher yields through wider use of fertilizers and better land husbandry; it means shifting to more food and feed crops for human and animal consumption because they produce the most nutrients per unit of land, labor, and equipment; it means similar drastic changes all along the agricultural production front may be expected. In short, it would appear that "farming as usual" is out, at least for 1944 and perhaps for the duration and for several years thereafter.

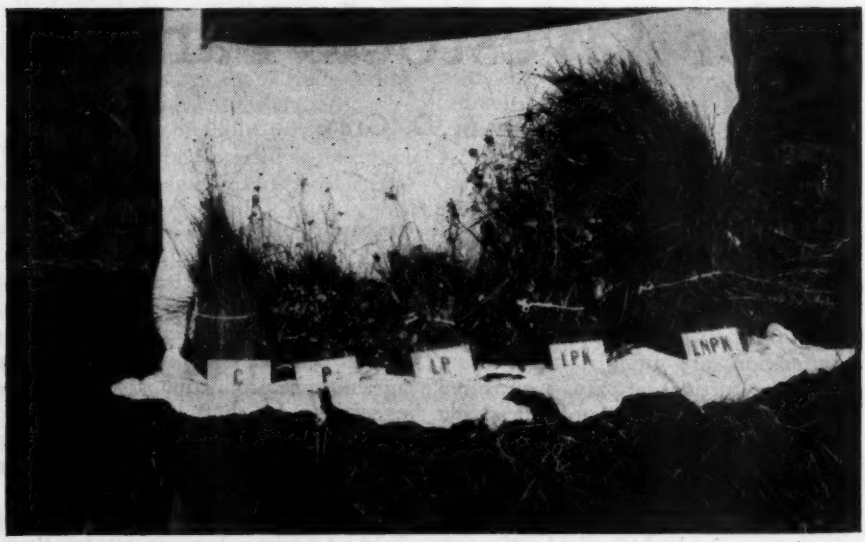
In a series of state meetings recently held, American farmers set for themselves a 1944 goal, which, if reached,

will be a new all-time agricultural production record. Acreage goals were established for all of the principal crops, and adjustments were made in the goals for livestock, poultry, and dairy products. The goals established in the livestock category, expressed in terms of percentage of 1943 production, call for an increase of 2% for milk and eggs and decreases as follows: farm chickens 4%, commercial broilers 16%, turkeys 3%, beef cattle and calves for slaughter 5%, sheep and lambs 2%, and hogs 15%. These goals might easily be interpreted to mean that there is adequate production of everything except milk and eggs, but this is not the case. It merely means that barring the unforeseen and in the light of the feed shortage, which is critical, the goals set are about the maximum that can be expected. In setting the goals for 1944, farmers not only made it clear that they would need adequate machinery, labor, and fertilizer, but that it would be necessary to have a continuation of the present price supports and in some cases, increased price supports.

Of all the farm commodities in which increases are needed, milk is still regarded as urgent. We need more milk for the strength and health of Americans, and vast quantities of cheese, evaporated milk, and dried skim milk for the Allied Nations fighting aggression. The demand for all of these products will undoubtedly be enormously increased when the fighting is over and the United Nations Relief and Rehabilitation Administration goes into full action.

In terms of crops, our increased milk output will require more hay and pastures and particularly more legume crops to serve the dual purpose of providing an economical source of feed for livestock and nitrogen for soil fertility. The acreage devoted to feed crops, therefore, will have to be adjusted in line with the increased requirements for livestock production.

These demands upon agriculture have come at a time when labor is scarce, and any increase in production will have to be accomplished with fewer farm workers. There probably never before has been a time when it was more important for farmers to follow the most efficient methods of production, utilizing to the fullest extent farm management practices which will result in maximum production with a



Square-yard samples of grass from pasture-fertilization plots in Maine. Unfertilized, phosphate only, lime-phosphate, lime-phosphate-potash, lime-nitrogen-phosphate-potash.

Although off to a poor start on its 1943 all-out effort, agriculture substantially met its high production goals.

minimum of labor. The importance of fertilizers in such a program should not be overlooked.

The suggested goal for milk production in 1944 for the country as a whole is 121,237,000,000 pounds. In terms of milk this is equivalent to an increase of approximately 367 million gallons. To achieve this increase, greater efficiency in production on most dairy farms will be required. How this may best be accomplished is indicated in the suggestions which follow:

1. Increased feeding of grain.
2. Better and possibly more frequent milking.
3. More efficient feeding of grain and roughage in relation to production.
4. Purchase of roughage if necessary to augment home supply.
5. More consideration to the health and comfort of the herd.
6. Purchase of more cows or culling less drastically, consistent with economic production.
7. Giving more attention to high quality supplemental feed crops, particularly pastures and legumes.
8. Practicing soil conservation.
9. Better care and handling of farm manure supply.
10. More liberal and efficient use of commercial fertilizers.

As far as the individual farmer is concerned, it would seem wise to expand production moderately. Insofar as possible he should avoid heavy committments for expansion of buildings or equipment involving increased indebtedness. He should not have to bring more acreage under cultivation. If increased production is obtained, it can and should come from our present lands, especially those adapted to intensive operation. It should be profitable to make such adjustments as heavier fertilization of crops, heavier feeding of livestock within the limits of feed supplies available, and certain of the other practices suggested.

During the present emergency and for a long time afterwards, dairy farmers are going to have to face many new problems. What they will be or how they will be solved, no one can predict. Of one thing, however, we can be reasonably sure—the dairymen who survive the crisis will be those who have placed their farms on a sound production basis.

In considering fertilizer from the standpoint of its efficient use in the

Hay or Feed	Nitrogen	Phosphoric Acid	Potash
Legume hays			
Winter Vetch	56	15	46
Alfalfa	49	10	42
Soybean	46	14	22
Red Clover	42	10	40
Alsike Clover	42	10	25
Sweet Clover	40	11	37
Field Pea	40	8	20
Grass hays			
Mixed	30	8	27
Timothy	25	11	20
Red-top	24	7	20
Orchard Grass	24	7	35
Kentucky Blue Grass	24	8	31
Annual grasses			
Common Millet	25	9	30
Barnyard Millet	26	9	55
Japanese Millet	22	8	24
Green Sorghum	6	24	6
Straws			
Buckwheat	25	3	23
Corn Stover	20	6	28
Oat	12	4	25
Barley	12	4	22
Rye	10	6	17
Wheat	10	3	12
Grains			
Soybeans	106	36	40
Peas (Field)	74	16	20
Cowpeas	62	20	24
Oats	40	16	12
Wheat	40	17	10
Barley	35	15	10
Rye	34	17	12
Corn	30	13	8
Buckwheat	30	12	6
Purchased Concentrates			
Cotton Seed Meal	140	60	35
Linseed Meal			
New Process	114	37	28
Old Process	106	35	26
Buckwheat Middlings	95	60	45
Cocoanut Meal	78	32	48
Gluten Feed (Star)	74	7	trace
Wheat Bran	53	58	32
Wheat Middlings	50	27	14
Oat Middlings	48	27	22
Barley Middlings	40	25	14
Rye Middlings	40	20	14
Corn Middlings	28	7	5
Root Crops			
Turnips	5	2.0	9
Carrots	4.6	2.6	10.6
Rutabagas	4	2.4	10
Yellow Beets	4	2	10
Mangels	3	2	7

vastly stepped-up emergency production program, it is desirable that we take stock of our plant-food resources on every dairy farm. Since manure constitutes the only farm plant-food resource other than the soil, the contribution it makes in valuable plant nutrients must be weighed against plant-food removal and livestock products sold off the farm. This accomplished, we will have a reasonably satisfactory basis for determining the need for commercial fertilizer.

In the livestock system of farming, it is possible to return to the soil a large proportion of the nitrogen and mineral nutrients that are removed from the field in the crops grown. If a considerable percentage of the land is devoted to legumes or if supplemental feeds are purchased and used in fairly large amounts, the total quantity of nitrogen that is applied to the soil in the form of manure may be in excess of that removed from it by crops and by the drainage water. With the other nutrient elements, however, no such compensatory processes operate.

Figures in the opposite column from Van Slyke's "Fertilizers and Crop Production" show pounds of plant-food material contained in one ton of the various hays and feeds.

Concentrates and legume hays are rich in plant-food material and should be used for their value in manure. In carefully conducted feeding tests, it has been found that the amounts of nitrogen and minerals of the feed recovered in the liquid and solid excrements are high. The percentage recoveries for phosphorus, nitrogen, calcium, and potash, for example, approximate 62, 74, 82, and 85% respectively.

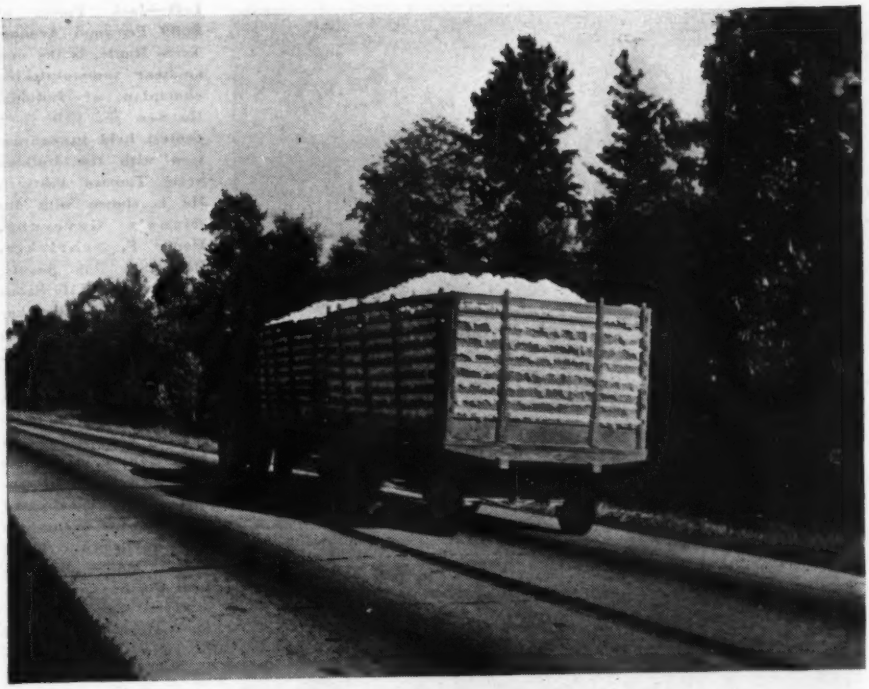
In contrast to the figures by Van Slyke showing plant nutrients contributed by certain hay crops and feeds, the following figures from Morrison's "Feeds and Feeding" will serve to give some idea of the losses that take place in animal products that are sold.

Studies on the distribution of nutrient materials in the urine and feces

(*Turn to page* 47)

LOOKING FORWARD TO "PEACE ON EARTH, GOOD WILL TOWARD MEN."

ALTHOUGH OFF TO A POOR START ON ITS 1943 ALL-OUT EFFORT,



AGRICULTURE SUBSTANTIALLY MET ITS HIGH PRODUCTION GOALS.

Left—Jack Fuson of 2809 Fenwood Avenue, Terre Haute, is the new amateur tomato-picking champion of Indiana. He won the title in a contest held in connection with the Indiana State Tomato Festival. He is shown with Indiana's Governor, Henry F. Schricker. Both are Boy Scouts, Jack being a Life Scout and Governor Schricker a Silver Beaver Scout. Jack is the son of Mr. and Mrs. M. C. Fuson. Below — The Indiana State amateur tomato-picking contest held in Vigo County in connection with the State Tomato Festival attracted entrants of beauty as well as brawn. These young ladies did not beat the boys, but they attracted quite a gallery of rooters. From left to right: Gertrude Ellington, Marilyn Bohannon, Barbara Smith, Thelma Olie, Betty Byrge, and Betty Higgins, all of Vigo County.

The Editors Talk

Agriculture 1943

American agriculture has finished another year of war. Starting out with such reverses as machinery and fertilizer shortages, an alarming labor situation, and a cold, wet spring, the farm front held its line, in most instances met the goals set for it, in others surpassed them.

The first set-back was the late, wet spring delaying to critical periods planting operations. In the Midwest, floods voided vast acreages and weeks of hard work on crops already in. Undaunted, these farmers set about replanting, gambling on a break in the weather which would favor even partial yields. It followed, and reports on the rapidity with which growth caught up to normalcy, amazing even to scientific circles, came out of these areas. Those farmers who were beaten by the weather quickly changed to the growing of some substitute crop in order to keep the land in production. Once the growing season was on, the situation remained promising. Such summer and early fall droughts as caused serious losses were fairly well localized.

Machinery and fertilizer shortages did not prove as detrimental as anticipated. Equipment was shared and the campaign to relieve the shortages of nitrogenous fertilizers by the growing of legumes was effective and successful.

The solving of the labor problem was one of the finest examples of the great cooperative spirit which has built this Nation into the World power it now is. Women's land armies were formed, business and professional men gave freely of their spare time, city workers turned farmers during their vacation periods, and schools arranged their curriculums so that students could be released to help during peak periods of farm labor need. Members of the armed forces proved an important factor, not only in devoting furlough time but in some instances being released from active duty in critical situations. Never before have the farm youth organizations been as active or as effective, and enrollment for the special training which they receive constantly increased.

According to "The Agricultural Situation" published by the Bureau of Agricultural Economics of the U. S. Department of Agriculture, the total food production in 1943 is now estimated to exceed the record production in 1942 by 5 per cent and the 1935-39 average by 32 per cent. Mainly as a result of unfavorable weather, this year's production of food crops will be lower than last, but an unprecedented output of livestock products will more than offset the reduction in food crops.

Cash farm income, including Government payments, will be close to 20 billion dollars in 1943, about 3.8 billion more than in 1942. Prices received by farmers in 1943 will average about 20 per cent higher than in 1942. Production expenses of farm operators are expected to be a billion dollars higher this year than last, but the net income remaining will be about 3 billion larger than in 1942.

In general, farmers are being very conservative with their improved financial status. Increased income taxes are taking a part of their greater returns, another

part is being spent on better living conditions, but much of it is being used to pay off indebtedness, improve the farm's productive capacity, purchase war bonds, and for other means to prevent a repetition of the deplorable conditions which brought disaster to America's agriculture following the last war.

Agriculture in 1943 played well its tremendous role in the Nation's war effort. That it will continue is seen in the preparations being made to meet the 1944 goals now being set.

The Dairyman and the War

Every farmer has been called upon to adjust his production to the needs for an early Victory. Of all the farm commodities for which increases are needed, the most urgent is for more milk. In terms of crops our increased milk output will require more hay and pastures, and particularly more legume crops to serve the dual purpose of feed for livestock and soil fertility maintenance.

These demands upon agriculture have come at a time when labor is scarce. There probably never before has been a time when it was more important for livestock farmers to follow the most efficient methods of production, utilizing to the fullest extent farm management practices which will insure maximum production with a minimum of labor. The importance of fertilizers in such a program is self-evident.

In considering fertilizers from the standpoint of efficient use, it is desirable that stock of the plant-food resources on every farm be taken. Since manure constitutes the dairy farmer's chief source of plant food, it should receive first consideration. Farm manure at best is an unbalanced fertilizer. When first voided, one ton of average manure contains approximately 10 pounds of nitrogen, 5 pounds of phosphoric acid, and 12 pounds of potash. Experiments have shown that over 90% of the potassium and more than half of the nitrogen are contained in the urine, while 98% of the phosphorus and 99% of the calcium are voided in the solid excrement. It is apparent that efficient use of manure calls for the preservation of the liquid portion and reinforcement with superphosphate. On the majority of dairy farms, especially where more legume crops are needed, reinforcement with potash may also be requird. Addition of from 50 to 75 pounds of superphosphate and 20 to 25 pounds of muriate of potash to each spreader load of manure, besides helping to preserve the nitrogen, increases the amount of phosphorus and potash, so that the treated manure contains these plant-food constituents more nearly in amounts required for the crops commonly grown.

Manure alone, even when reinforced with phosphorus and potash, is never abundant enough to supply the plant-food needs of the normal cropland and pasture acreage. It will be necessary, therefore, that the major portion of the plant nutrients, particularly for the permanent grass and legume pastures, be supplied as commercial fertilizers.

What fertilizers to use, how much, and the best methods of application have been largely determined by State Agricultural Experiment Stations. Numerous dairy research farms throughout the country are demonstrating in a very practical way that the findings of the research workers can be profitably applied. County agents and extension specialists are taking direct to the farms the best lessons that research has developed. The contributions of these men provide dairy farmers abundant ammunition for an all-out contribution to our present national food and feed emergency.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21 59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7 53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
November	19.22	39.8	108.4	103.5	75.9	104.4	9.84	45.01	....
December	19.55	40.0	111.8	110.3	80.2	110.3	10.46	44.72	....
1943									
January	19.74	35.1	117.8	121.4	88.0	117.5	11.20	44.34	....
February	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	....
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....

Index Numbers (1910-14 = 100)

1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
November	155	383	156	118	117	119	82	208	238
December	158	385	161	126	124	125	88	207	293
1943									
January	159	338	169	139	136	134	94	205	277
February	159	175	181	148	140	136	100	208	301
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	295

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.30
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
November	1.75	1.42	6.06	5.77	3.34	4.86	6.53
December	1.75	1.42	5.68	5.77	3.34	4.86	6.53
1943							
January	1.75	1.42	5.68	5.77	3.34	4.86	6.53
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
November	65	50	173	163	110	144	186
December	65	50	162	163	110	144	186
1943							
January	65	50	162	163	110	144	186
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24 18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23 32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23 72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
November	.600	2.00	5.90	.535	.817	26.00	.210	....
December	.600	2.00	5.90	.535	.817	26.00	.210	....
1943								
January	.600	2.00	5.90	.535	.817	26.00	.210	....
February	.600	2.00	5.90	.535	.817	26.00	.210	....
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	116	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	116	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
November	112	55	121	75	86	108	85	....
December	112	55	121	75	86	108	85	....
1943								
January	112	55	121	75	86	108	85	....
February	112	55	121	75	86	108	85	....
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	142	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	157	151	112	100	131	109	80
1926.....	145	155	146	119	94	135	112	86
1927.....	139	153	139	116	89	150	100	94
1928.....	149	155	141	121	87	177	108	97
1929.....	146	153	139	114	79	146	114	97
1930.....	126	145	126	105	72	131	101	99
1931.....	87	124	107	83	62	83	90	99
1932.....	65	107	95	71	46	48	85	99
1933.....	70	109	96	70	45	71	81	95
1934.....	90	123	109	72	47	90	91	72
1935.....	108	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	121	130	126	81	50	129	95	75
1938.....	95	122	115	78	52	101	92	77
1939.....	93	121	112	79	51	119	89	77
1940.....	98	122	115	80	52	114	96	77
1941.....	122	130	127	86	56	130	102	77
1942.....	157	152	144	93	57	161	112	77
November.	169	156	146	93	57	158	112	79
December..	178	158	147	92	57	154	112	79
1943								
January...	182	160	149	92	57	154	112	79
February..	178	162	149	92	57	155	112	79
March....	182	163	150	93	57	160	113	79
April.....	185	165	151	95	57	160	119	79
May.....	187	167	152	95	57	160	119	79
June.....	190	168	151	93	57	160	119	69
July.....	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	192	171	150	95	57	160	119	78

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizer

"Bureau of Chemistry Annual Report for the Calendar Year 1942," Dept. of Agr., State of Calif., Sacramento, Calif., 1942.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended September 30, 1943," Dept. of Agr., State of Calif., Sacramento, Calif., FM-72, Nov. 4, 1943.

"Fertilizer Recommendations for the Maritime Provinces," Sp. Ed. for 1944, The Maritime Fertilizer Council, Moncton, N.B.

"Effect of Fertilizer on Growth and Composition of Carpet and Other Grasses," Agr. Exp. Sta., Gainesville, Fla., Bul. 390, July 1943, R. E. Blaser and W. E. Stokes.

"The Effect of Nitrogen Fertilization on Cold Injury of Peach Trees," Ga. Exp. Sta., Experiment, Ga., Bul. 226, July 1943, B. B. Higgins, G. P. Walton, and J. J. Skinner.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 288, May 1943.

"Fertilizers for Kentucky July 1, 1943 to June 30, 1944," Ext. Div., Univ. of Ky., Lexington, Ky., E. J. Kinney.

"Nitrate Production as Affected by Grain-Crop Residues on the Surface of the Soil," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., R. Bul. 131, Aug. 1943, T. M. McCalla and J. C. Russel.

"Fertilizer Sales by Grade in Order of Tonnage July 1, 1942 to Dec. 31, 1942," N. C. Dept. of Agr., Raleigh, N. C.

"Fertilizer Sales by Grades in Order of Tonnage Jan. 1, 1943 to June 30, 1943," N. C. Dept. of Agr., Raleigh, N. C.

"What Response May Be Expected from Trace Element Fertilization on Ohio Soils," Ohio State Univ., Columbus, Ohio, Oct. 29, 1942, O. J. Kelley.

"Inspection of Fertilizers," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Con. 632, March 1943, E. J. Deszyck and John J. Havern.

"Fertilizer Recommendations for South Carolina Crops for 1943-1944 Crop Season," Clemson College, Clemson, S. C.

"Recommendations for the Use of the Approved Grades of Fertilizer for Texas in 1943-44," Texas Agr. Exp. Sta., College Station, Texas, Cir. 102, Oct. 1943, G. S. Fraps, G. A. Kelt, E. A. Miller, E. B. Reynolds, J. F. Rosborough, and S. H. Yarnell.

"Fertilizer Consumption in 1941 and Trends in Usage," U. S. D. A., Washington, D. C., Cir. 689, Oct. 1943, A. L. Mehring and Grace P. Vincent.

"Grade Survey Year Ended June 30, 1943," Agr. Res. Adm., U. S. D. A., Washington, D. C., Nov. 1943, A. L. Mehring and Hilda M. Wallace.

"The Use of Ammonium Nitrate in Mixed Fertilizers," Agr. Res. Adm., U. S. D. A., Washington, D. C., Sept. 1943.

Soils

"Land Cover in Relation to Water Control and Utilization in the Upper French Broad River Watershed," Ext. Serv., N. C. State College, Raleigh, N. C., E. Bul. 339, June 1943, William D. Lee.

"Greenhouse Studies of the Toxicities of Oklahoma Salt Contaminated Waters," Agr. Expt. Sta., Okla. A. &M. College, Stillwater, Okla., T. Bul. No. T-20, Octo. 1943, Robert F. Wall and Frank B. Cross.

"Soil Survey Coos County, New Hampshire," U. S. D. A., Washington, D. C., Series 1937, No. 5, August 1943, B. H. Williams, W. H. Coates, and P. N. Scripture.

Crops

¶ A helpful pamphlet on the growing of high quality leguminous hay has been prepared by J. M. Weeks and issued as Mississippi Agricultural Extension Leaflet No. 43, entitled, "Grow More Legume Hay." The crops covered are lespedeza, soybeans, and cowpeas. Information on planting, variety, fertilization, and harvesting is given. In the fertilization of lespedeza for hay, it is suggested that 200 lbs. of superphosphate and 500 lbs. of lime or 600 lbs. of basic slag be used along with 50 lbs. of muriate of potash per acre. In the fertilization of soybeans, it is suggested that 500 lbs. of basic slag or 150 to 200 lbs. of superphosphate and 500

lbs. of limestone along with 50 lbs. of muriate of potash per acre be used. For cowpeas the same fertilization as for soybeans is recommended. While these crops frequently will make a fair growth without fertilization, they usually will make much better growth when properly fertilized and well repay for the materials used.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1943," Ottawa, Canada.

"Hay Making With Crested Wheatgrass in the Dry Areas of Alberta," Dom. Exp. Sta., Lethbridge, Alberta, Publ. 753, F. B. 119, July 1943, R. W. Peake and H. Chester.

"The Wartime Garden," Agr. Supplies Board, Ottawa, Canada, Sp. Pamphlet 75.

"22nd Annual Report of the Canadian Plant Disease Survey 1942," Dept. of Agr. Science Serv., Central Exp. Farm, Ottawa, Canada, May 1943.

"Fifty-Fifth Annual Report," Ga. Exp. Sta., Experiment, Ga., Year 1942-43.

"Idaho Agricultural Publications Available for Free Distribution," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 87, March 1943.

"Comanche and Pawnee: New Varieties of Hard Red Winter Wheat for Kansas," Agr. Exp. Sta., Kansas State College of Agr., Manhattan, Kansas, Bul. 319, July 1943, L. P. Reitz and H. H. Laude.

"The Development of Sorghums Resistant to Milo Disease," Agr. Exp. Sta., Kansas State College of Agr., Manhattan, Kansas, T. Bul. 55, July 1943, L. E. Melchers and Alvin E. Lowe.

"Fifty-Fifth Annual Report," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., 1942.

"Annual Report, June 30, 1943," Maine Ext. Serv., Orono, Me., E. Bul. 317, Nov. 1943.

"Weather in Cranberry Culture," Mass. Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 402, April 1943, Henry J. Franklin, H. F. Bergman, and Neil E. Stevens.

"Grape Culture in Massachusetts," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 64, Rev. April 1943, O. C. Roberts.

"Pasture Plants and Combinations," Univ. of Minn., Univ. Farm, St. Paul, Minn., E. Bul. 197, Rev. June 1943, Ralph F. Crim and A. C. Arny.

"Fifty-Fifth Annual Report, June 30, 1942," Miss. Exp. Sta., State College, Miss., Nov. 5, 1942, Clarence Dorman.

"Planting Cottonwood on Bottomlands," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 391, August 1943, Henry Bull and H. H. Muntz.

"Serving New Hampshire Farms and Homes," A. R., Ext. Serv., Univ. of New Hampshire, Durham, N. H., Bul. 63, June 1943, H. B. Stevens.

"Control of Insects and Diseases in the Home Garden," Agr. Ext. Serv., Univ. of N. H., Durham, N. H., Cir. 253, May 1943, Mathias C. Richards and James G. Conklin.

"Ladino Clover for New Hampshire," Agr. Ext. Serv., Univ. of N. H., Durham, N. H., Cir. 254, May 1943, J. L. Haddock.

"Cattle Feeding as a Method of Marketing Alfalfa on Irrigated Farms," Agr. Exp. Sta., State College, N. Mex., Bul. 307, June 1943, H. B. Pingrey.

"Italian Rye Grass," Agr. Ext. Serv., State College, Raleigh, N. C., W. S. Bul. 22, Aug. 1943.

"Austrian Winter Peas, Crimson Clover, and Vetch," Agr. Ext. Serv., State College Sta., Raleigh, N. C., W. S. Bul. 24, Sept. 1943.

"Fifty-Fifth Annual Report," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Con. 615, June 1943.

"Pasture Improvement in Upshur County," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 308, July 1943, G. G. Pohlman and F. D. Dornell, Jr.

"Results of Hybrid Corn Yield Trials in West Virginia for 1942," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Mimeo. Cir. 46, Feb. 22, 1943, E. J. Wellhausen.

"Forage for Fall Feeding," U. S. D. A., Washington, D. C. AWI-62, Sept. 1943.

"Legume Cover Crops to Boost Production in the South," U. S. D. A., Washington, D. C., AWI-67, Sept. 1943.

Economics

"Farm Planning in the Eastern Ozarks," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 435, June 1943, Otis T. Osgood.

"Costs and Returns from 453 Family-Sized Sugar Cane Farms for the Crop Year 1940 With Some Comparisons for 1938," Dept. of Agr. Econ., La. State Univ., Baton Rouge, La., Mimeo. Cir. 25, March 1942, J. N. Efferson.

"Trends in Wartime Farm Prices in Maryland," Univ. of Md., College Park, Md., Bul. A25, May 1943, P. R. Poffenberger and S. H. DeVault.

"The Plantation Land Tenure System in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 385, June 1943, Frank J. Welch.

"Retail and Wholesale Distribution of Apples in Upstate New York," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 794, May 1943, M. E. Cravens.

"North Carolina Fights With Extra Food," Ext. Serv., N. C. State College, Raleigh, N. C., W. S. Bul. 28, Nov. 1943.

"Ohio Agricultural Statistics 1940 and 1941," Agr. Exp. Sta., Wooster, Ohio, Bul. 642, June 1943, Glenn S. Ray, Oakley M. Frost, and P. P. Wallrabenstein.

"Migration of Population in Five Oklahoma

Townships," Okla. Agr. Exp. Sta., Stillwater, Okla., E. Bul. No. B-271, Oct. 1943, Robert T. McMillan.

"Negro Farmers in Wartime Food Production, U. S. D. A., Washington, D. C., the Farmer and the War—6, October 1943.

"Soybeans Go to War," U. S. D. A., Washington, D. C., BAE-Ext. Flier-7, 1943.

Yearly Crops from Farm Woodlands

(*From page* 16)

some pruning may be necessary, but that will usually mean some firewood for the house. Later comes the actual work of selectively cutting the crop for annual sale. No more stripped woods and hodgepodge growth of just any kind of trees. Continuous high-value yield is the object.

All the farmers who came into the plan were not versed in felling, sawing, and skidding but these skills are soon re-learned. These farmers have found that, if they use skill and good judgment, they can get several dollars more per thousand feet of logs when working trees into logs of different lengths and grades. Ordinary farm equipment is usually adequate.

Fitting the work into the farm schemes is likely to involve shifts in rotations that must be carefully considered. It is not a matter for haste. Some of these farmers need credit in order to withstand the necessity for selling off the whole woods to some itinerant sawmill or to make the necessary changes in their farm plans. Others haven't the labor it would take.

But hundreds are working into the plan. Recently the Department of Agriculture studied 90 farms on which such shifts are underway. To make a long story short, the cash receipts from the woodlands, mostly from the sale of sawlogs and fuel, and from off-the-farm work in the woods industry amounted to $170 per farm, or about 5 per cent of the total income from the farm.

Sawlogs brought more than 80 per cent of these receipts. Under present good management and growth conditions the sawlog cut is a yearly removal not much above the annual growth of merchantable woods on these farms. In fact, the quality and growth rate of the stand that remains will probably increase. If the acreage of the woods can be increased the potential returns will be still higher.

Breaking that woods income down, it was evident that farmers who had from 20 to 50 acres of merchantable timber in average condition or better got about $250 each from the woods crop without cutting any more heavily than the average. Those with this acreage of woods in poor shape realized only $15 each. Those having 10 acres or less of merchantable timber averaged $137 each from their woods. The largest amount received by any one farmer from his woods was $770. This income represented some accumulation of woodland growth as the tracts usually had not been cropped for a few years.

These farmers are, of course, fortunate in having a steady outlet for small quantities. Even so, many farmers in the community are not taking advantage of it. But enough have been giving the farm-forestry idea a real trial to make evident that with care, foresight, and some expert farm and forestry advice many farmers in our northeastern States could get a steady income from their woodlots, through their own and neighbor work, at the same time they are improving their woods and furnishing a product that is in ever greater demand as the metals disappear into the war.

The Department is now making

somewhat similar studies of the possibilities in parts of the Southern Appalachians. War increases the prospects there for farm-forestry developments at the same time that it is offering the wood-working industries, that frequently employ farm people, a chance to expand.

What's in that Fertilizer Bag?

(*From page* 22)

acid (P_2O_5) depending principally on the quality of rock phosphate used.

Granulated superphosphate is now produced in one direct operation to contain 20 to 21% available phosphoric acid.

The trade also produces "double" or "triple" superphosphate (40 to 48% available P_2O_5). This grade looks like ordinary superphosphate but its chemical composition is different especially with respect to the calcium sulfate (gypsum) content. It is produced by acidulating rock phosphate first with sulfuric acid in about the same way as in making ordinary superphosphate. The gypsum is then filtered off by extraction and discarded. The phosphoric acid so produced is then concentrated and used to treat more rock. Because of its high concentration of available P_2O_5, it is particularly well suited in the preparation of high-analysis complete fertilizers. Field tests show that for direct application it does not always seem to be as well suited as the 18 to 20% grades. The more favorable difference in crop response for the ordinary grades has been traced to the gypsum content.

The Potash Materials

When World War I involved the United States, our farmers were entirely dependent on German sources for potash. Prices soared dizzily during that war, going as high as $500.00 per ton. Today, thanks to the expansion of our domestic potash industry, our farmers are being supplied from potash produced within our own borders. Brine from Searles Lake in California and the Salduro Marshes in Utah and salt deposits near Carlsbad, New Mexico, form the basis of our domestic industry. Small quantities of potash also are contributed by tobacco wastes, sugar refineries, flue dusts of cement factories, and by the alcohol industry.

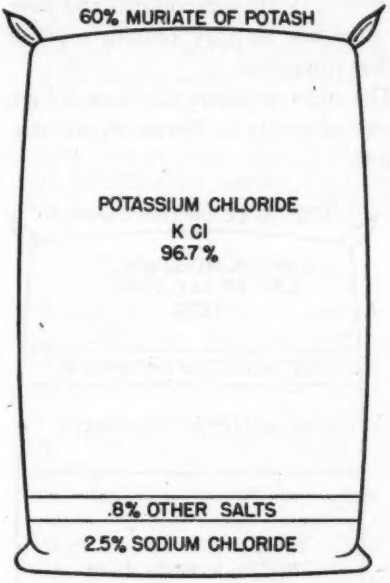
The potash salts used in fertilizers are water soluble and are, therefore, quickly available. The chemical symbol for potash is "K_2O" (K two O); for potassium it is "K". The words potash and potassium and their symbols are often used interchangeably to mean the same thing. The fertilizer trade has used the word "potash" and the symbol "K_2O" to mean the same thing and the habit seems strongly entrenched.

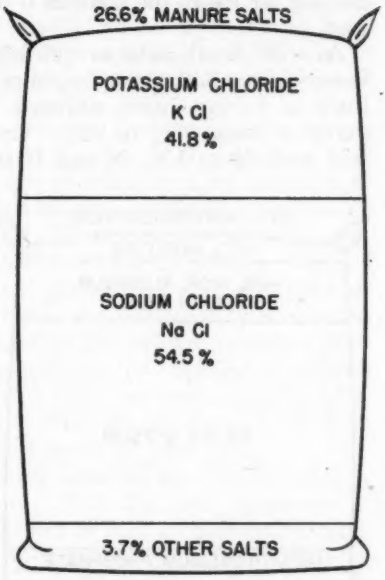
The important sources of potash with their K_2O content are as follows:

(1) *Mineral:*	*Per cent K_2O*
Muriate of potash (potassium chloride)	48 to 62
Sulfate of potash	48 to 52
Manure salts	22 to 32
Kainite	14 to 20
Nitrate of soda and potash	12 to 14
Nitrate of potash	44 to 45
Potassium phosphate	30 to 50
Sulfate of potash-magnesia	22 to 27
(2) *Vegetable:*	
Tobacco stems	5 to 9
Cottonseed meal	1 to 2
Castor pomace	1 to 1.5
Tankage	4 to 15
Hardwood ashes	1.5 to 8
Cottonseed hull ashes	3 to 7

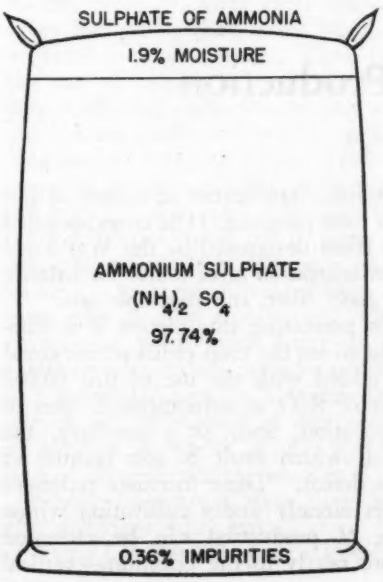
(3) *Industrial:* Small quantities come from sugar refineries, the alcohol industry, flue dusts of cement factories, and a few other industries.

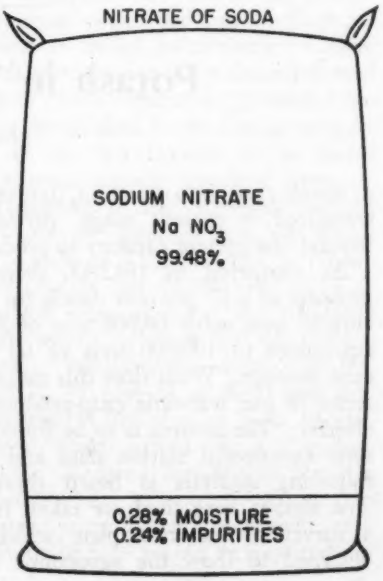
Perhaps the best way to explain some of the concentrated plant-food materials is by diagrams.





Speak of 60% muriate and the question is often asked, "What's the rest of it?" "Filler?" No, there is no filler. The percentage figure is the chemist's analysis of the actual amount of K present in this material calculated to a K_2O basis. Muriate of potash containing 60% "potash" or potassium oxide (K_2O) is a chemical salt containing about 95% potassium chloride, and about 5% by weight of other salts or, if you will, impurities. Pure potassium chloride contains 63.2% K_2O. American potash producers are now able to refine potash salts to as high a purity as possible commensurate with cost and

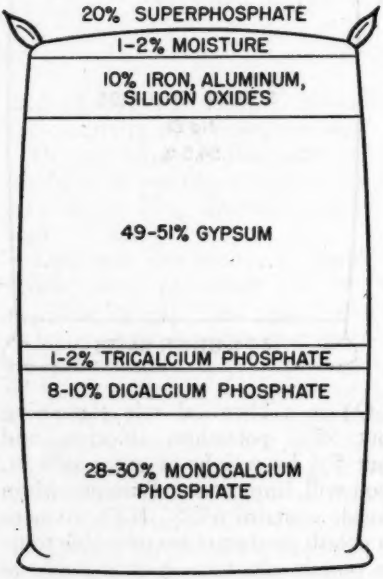


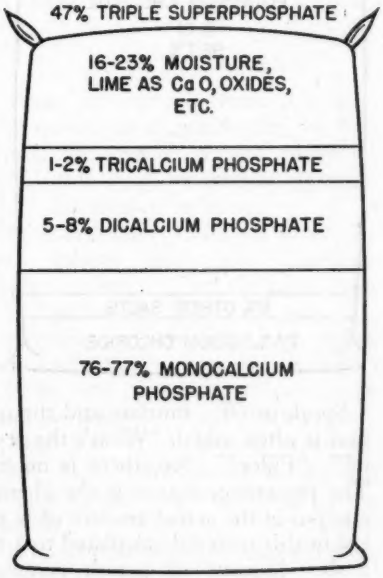


purpose for which the material is to be used.

As with potash salts, so with nitrogenous salts: Sulfate of ammonia is listed as having 20.5% nitrogen. Its purity is about 97% to 98%. Cyanamid with 21 to 22% N and Uramon with 42% N are concentrated and have no filler nor do they contain a lot of useless impurities.

The superphoshates also have a high degree of purity as shown by the diagrams.





Potash in War Production

(*From page* 14)

a whole runs into startling figures as compared to present usage, definitely beyond our present capacity to produce.

As compared to 1942-43, there is prospect of a 10 per cent deficit for the current year, some 60,000 tons of K_2O equivalent to 100,000 tons of 60 per cent muriate. What does this mean in terms of our war-time crop-production efforts? The answer is to be found in state experiment station data and the following analysis is based thereon. The figures here cited are taken from a survey as yet incomplete which is designed to show the agronomic and economic significance of potash in our war food program. The crops specified are those designated by the War Food Administration as of major importance for food, fiber, and vegetable oils.

In presenting this picture it is sufficient to see the crop yields which could be added with the use of this 60,000 tons of K_2O at demonstrated rates of application, and, as a corollary, the yields which must be lost because of this deficit. These increases represent acres already under cultivation whose rate of production can be increased more nearly to the optimum—vertical

as contrasted to horizontal increases in production, of special wartime significance, for it is well known that labor and machinery supplies are inadequate for the best cultivation of the acreages already employed. It is a pertinent answer also to those who dismiss our food problem by saying, "we must plow up an additional 40 to 45 million acres".

Returns from Potash

Beginning with Illinois, you are familiar with the elaborate summaries and analyses of data obtained from experimental fields recently issued by Bauer and associates. Bray's potash map shows that the soils of the southeastern part of that State are relatively potash-deficient, comprising some 15 per cent of the entire State area, or 5,200,000 acres, one-half of which or 2,600,000 acres is under cultivation. Using the data from the eight experimental fields located in this section of the State and the per acre rate of 50 pounds of K_2O used in these experiments with the grain system of rotation—corn, soybeans, and wheat—the results show a net increase of 32.5 per cent in crop value attributable to the potash alone. In other words, with potash, each 100 acres yield crop volumes for which 132.5 acres would be required without potash. Thus, from the use of 125,000 tons of K_2O, the crop-producing equivalent of this acreage already under cultivation could be increased to 3,445,000 acres. Here are crops of great food value produced at the high per-acre rates that have won for the North-Central tier of states the designation of "the Nation's breadbasket". In these Illinois results are other data of great significance. Comparing the yields from complete fertilization with county averages we find: 112 bushels of corn *vs.* a county average of 42; 72 bushels of oats *vs.* 34; 34 bushels of wheat *vs.* 21; and 2.5 tons of clover-alfalfa hay *vs.* 1.7.

Equally significant data have been obtained from other states.

Maine has 200,000 acres in potatoes. If the additional 80 pounds of K_2O per acre recommended by Chucka were available, amounting to 8,000 tons of K_2O, the increased yield would amount to 2.4 million bushels.

In North Carolina, with 100,000 acres in potatoes, at 60 pounds of K_2O per acre or a total of 3,000 tons of K_2O additional, the increased yield would be 1.2 million bushels. In that State, 300,000 acres are in peanuts: with 15 pounds of K_2O per acre or 2,300 tons of K_2O, the increased yield would amount to 10.1 million pounds. With 40 pounds of K_2O applied to 850,000 acres of sweet potatoes, requiring 1,700 tons of K_2O, an additional 1.7 million bushels could be produced.

North Carolina has 850,000 acres in cotton. With the next increment of 20 pounds of K_2O recommended, totaling 8,500 tons of K_2O, the increase resulting would be 24.7 million pounds of lint, 9.9 million pounds of oil, and 17.25 million pounds of cottonseed meal; while in the adjoining state of South Carolina, with 1,100,000 acres in cotton and with an increment of 15 pounds of K_2O per acre, totaling 8,200 tons of K_2O, the increased yield would be 46.2 million pounds of lint, 18.5 million pounds of oil, and 32.3 million pounds of cottonseed meal. Your attention is called particularly to these yields of vegetable oil and concentrated animal feed, essential products too often overlooked in placing all emphasis on the lint because of its major importance among vegetable fibers.

Returning to the Midwest, Indiana has 4,300,000 acres in corn, for which 30 pounds of K_2O per acre is recommended. If the 64,500 tons of K_2O required were at hand, the increased yield would amount to 43 million bushels. Similarly for wheat, 1,100,000 acres at 20 pounds of K_2O per acre requiring 11,000 tons of K_2O, the increased yield would be 3.3 million bushels. Indiana has 50,000 acres in tomatoes. At 30 pounds per acre as the next recommended increment, only 800 tons of K_2O would be required but

the increased yield would be 400 million pounds.

The fertilized pasture of legumes or mixed grass and legumes is now recognized as the cheapest and the most important and labor-saving source of forage for livestock and dairy herds, of great importance in our war effort. Under New Jersey conditions, for example, 1 pound of K_2O yields 14 pounds dry weight of grass-clover, or 36 pounds dry weight of ladino clover hay, equivalent, respectively, to 8.4 and 21.6 tons of hay per ton of 60 per cent muriate.

Such are the data obtainable from our experiment station records, typical of a great mass subject to similar analysis if more evidence were needed to show the importance of potash in balanced crop nutrition. Potential increases unrealized represent losses from the aggregate farm effort. They represent losses in income to the individual farmer. At the current South Carolina price of 21¢ per pound for cotton lint and $50 per ton for cottonseed, a ton of 60 per cent muriate of potash has a gross value of $1,345 in terms of increased crop yields. That is what the cotton farmer stands to gain as the result of an adequate supply. Similar calculations for the other increases cited above serve to show that the wholesale price of $28.50 per ton of 60 per cent muriate is a wholly inadequate expression of value as it relates to our agricultural economy.

These figures are official and are circumscribed by the usual variables encountered in experimental work. They have been chosen in terms of their accessibility. They are not exceptions, many of them being ten-year averages. If the totals appear sensational it is because we have had little occasion heretofore to project per acre values into the realm of state-wide crop production efforts.

Most Efficient Use of Supplies

Never before in our history have we been called upon for such an agricultural effort as that in which we are now engaged. Its magnitude and the penalties of failure are such as fully to justify a close scrutiny of every pertinent factor and to deal realistically with those that block our success. We are now told that it is beyond our capacity to become the "world's breadbasket" for the duration of the war and the reconstruction period. A consideration of what that may mean in terms of human misery spurs us to greater effort, not despair. It was our ambition to become the "arsenal of democracy", under which generous impulse was made the Lend-Lease allocation of potash salts, the major cause of our present deficit in supply. The degree to which its adverse effect on North American production was weighed against its favorable effect on English production has not been disclosed. Since this allocation was granted, Allied success in opening the Mediterranean has vastly increased the accessibility of potash supplies from both Palestine and Spain, while Russian supplies are no more remote. Cargo space has been greatly augmented and the U-boat menace reduced. Great progress has been made in the dehydration of the bulkier food products. Accordingly, there does not appear to be any cogent reason why this Lend-Lease allocation should not be reviewed in the same fine cooperative spirit in which it was granted. The conclusion seems obvious that the most immediate and effective way to overcome this deficit in potash supply is to secure British requirements from sources less intimately related to North American food-production capacity. The sole proper issue is—Where will this tonnage best promote the war effort?

In seeking the most efficient use of the limited supplies of nitrogen, phosphorus, and potassium at our disposal, we are fortunate that we have the information provided by the agronomists as to the most efficient combinations of the three: plant-food ratios as recommended by State authorities. These are based on a half-century of research, experimentation, and demonstration, and relate not only to per acre rates of ap-

plication but also to the interdependence of the three plant foods in yielding the maximum efficiency of each individually and of the three in combination. The ratio recommended being the most efficient, in light of present information, to change that ratio results in the loss of efficiency of each plant food individually and of the combination. We are all familiar with "induced deficiencies" resulting from unbalanced ratios. It seems clear, therefore, that we are guilty of a gross fallacy when we attempt to juggle grades to fit the supply situation instead of the crop requirement; it is efficient crop production that will promote the war effort and not just tons of fertilizer. The War Food Administration has designated the preferred crops and has assigned them priorities. The more logical procedure would appear to be to juggle rates of application in terms of these priorities instead of sacrificing the efficiency of the ratios applied. These ratios are the foundation of our fertilizer industry. They are the scientific basis without which we would immediately become the vendors of patent medicine types of products. There has been no time in American history when we had greater need than now to apply the best we have in agricultural science.

Nor can one find any promotion of the war effort in reducing the plant food content of fertilizer mixtures, even though the approved ratio may be retained. It is obvious that with the current exportation to England of 152,000 tons out of a total production of 275,000 tons of concentrated superphosphate, in addition to the proposed exportation of potash, some of the most concentrated mixtures can no longer be made. This refers to the 40 per cent or better grades and not the 20 per cent or poorer grades. The reduction of the plant-food content of the mixture automatically increases the content of the inert, whether that be filler or the unavoidable constituent of the plant-food carrier. Substituting filler for plant food requires more labor and bags in the mixing plant, more space in boxcars and trucks, more gas and rubber for trucks and tractors, and more farm labor to distribute. This is contrary to public policy. Rationing is now a familiar phenomenon of our wartime existence, but the policies pertinent thereto do not contemplate the dilution of the commodities rationed. In the words of one well-known agronomist, "It doesn't take much sand to satisfy the silica requirements of the average crop!"

Such, then are some of the implications of a 10 per cent deficit in potash supply for American agriculture, serious in its repercussions on that essential war industry.

Potash in Chemical Industry

Turning now briefly to our chemical industry, we have noted an allocation of 85,000 tons of K_2O as compared to the 67,300 tons delivered during the 12-month period, June to May 1942-43. This is a wartime increase from 15,000 tons of K_2O delivered during the last prewar year, 1938. These increases are due to expansions in peacetime manufacture of the many products using potash chemicals; to the replacement of imports, notably the chlorates; to the manufacture of munitions, as, for example, potassium nitrate; to the military needs for peacetime products, such as the superior potash glasses for optical and precision instruments. Superimposed are new uses, still more or less shrouded in secrecy, in the metallurgical industries, notably magnesium and aluminum, in the production of high-octane gasoline, and in the synthetic rubber industry. Rumors relate to mysterious new and enlarged uses for the perchlorate and the persulfate. New compounds such as the pentaborate and potassium zinc chromates appear on the list of industrial chemicals. New metaphosphates for industrial use are under development.

These new uses and expansion in the old show promise of permanence. There appears to be no logical reason why we should return to foreign sources

of supply with the abandonment of our own. Chlorate and nitrate were our principal chemical imports in the category of potash chemicals. While our present potassium nitrate industry to a considerable extent at least depends on the old process of double decomposition of sodium nitrate and potassium chloride, the newer technologies for this manufacture are being widely discussed as a postwar outlet for our more abundant supplies of synthetic ammonia, from the fertilizer rather than the chemical viewpoint, however, for the agricultural value of potassium nitrate is thoroughly well established and represents a large potential demand.

Presented before the Division of Fertilizer Chemistry at the 106th meeting of the American Chemical Society, Pittsburgh, Penna., and reprinted from Chemical and Engineering News, Nov. 10, 1943, issue.

Some Characteristics of Manganese

(*From page* 8)

TABLE 5.—MANGANESE CONTENT OF GRASSES WITH VARIOUS NITROGEN CARRIERS. NEWTON FIELD DATA, JUNE 22, 1942.

Nitrogen Carrier	Soil pH	Percentage composition			
		Bluegrass	Timothy	Redtop	Bromegrass
$CaCN_2$	6.5	.0040	.0060	.0110	.0150
$NaNO_3$	6.6	.0050	.0065	.0140	.0160
$(NH_4)_2 SO_4$	4.8	.0220	.0110	.0340	.0200
Soybean Meal	5.4	.0070	.0100	.0210	.0180

parts of the soybean plant, but had little effect on the iron content (table 4). There was a very high iron concentration in the soybean leaves as they matured and dropped from the plant. This increase was more than ten times the concentration from green to mature or dropped leaves—.054 per cent green to .558 per cent mature, and .033 per cent green to .527 per cent iron in mature leaf tissue. The mature or dropped leaves were slightly higher in manganese than the green leaves, while the nitrogen content of the green leaves was higher than that of the dropped leaves which was just the reverse of that of iron and manganese.

Nitrogen carriers—sodium nitrate, calcium cyanamid, and ammonium sulphate—applied to the soil in moderate amounts over several years changed the reaction of the soil and also had a marked effect upon the uptake of manganese by various grasses (table 5). These fertilizers affected the hay yields, but aside from this, there was little change in percentage nitrogen or the content of other minerals (P, K, Ca, Mg, Fe) in the hay. The different grasses—Kentucky bluegrass, timothy, redtop, and bromegrass—required or took up different amounts of manganese. Under the more favorable soil reactions (pH 6.5, 6.6), bluegrass and timothy had the lower concentrations, while redtop and brome contained higher concentrations.

Apparently, these grasses do not require these higher concentrations of manganese but are tolerant of this element and are able to flourish under quite variable nutritional conditions. In

1941, redtop from the Schuett farm in northern Illinois on a calcareous soil area (pH 7.1 to 7.5) produced a satisfactory hay yield which contained .0037 per cent manganese. On the Reich farm in central Illinois on a calcareous soil (pH 8.2), bluegrass yielded 2,400 pounds an acre of hay with a manganese content of .0032 per cent. The Newton soil (table 5) also produced satisfactory bluegrass and redtop hay yields having as high as .022 per cent and .034 per cent, respectively, of manganese. The nitrogen and mineral content of the Schuett farm redtop varied but slightly from that at Newton.

Adding limestone to soils is usually one of the first essentials in soil improvement, and this apparently controls the availability of manganese. Under these conditions, there should be little difficulty in controlling an excess of this element in Illinois soils.

There may be deficiencies of manganese in grain when used for feed. Such shortages as this may be overcome either by feeding manganese salts or by allowing animals or birds access to feeds containing leafy material.

In Illinois, there has so far been found no evidence of injury to crops from manganese deficiencies, even on alkaline soils (pH 7.1 to 8.2). Plant material (redtop, bluegrass, corn) from these alkaline soils has been found to contain a percentage of manganese comparable with that of plant material from some non-alkaline soils.

Commercial Fertilizers for Livestock Farms

(*From page* 26)

show that over 90% of the potassium and more than half of the nitrogen are contained in the urine, while most of the phosphorus and calcium, 98 and 99% respectively, are voided in the feces.

Kind	Per cent Fertilizer Constituents			Fertilizer Value per ton
	N	*P*	*K*	
Fat Steer	2.56	0.59	0.14	$7.15
Fat Pig	2.32	.37	.13	6.10
Milk	.56	.09	.14	1.61
Butter	.14	.02	.01	.37

Farm manure at best is an unbalanced fertilizer and must be so regarded. The analysis of an average sample is given in the next table.

Manure is subject to serious depreciation through losses of urine and fermentation. Assuming that one-half of the nitrogen, one-fifth of the phosphoric acid, and one-half of the potash are readily available, it would require

Constituents	Per cent	Lbs. per ton
Water	73.00	1460
Dry Matter	27.00	540
Nitrogen	.50	10
Phosphoric Acid	.25	5
Potash	.60	12

20 tons of average manure to be the equivalent of one ton of a 5-1-6 fertilizer. Thus the theoretical value of manure based on the plant food it contains when first voided and its actual value as ordinarily handled and used are entirely different matters.

In the northeastern United States most of the forage grown is consumed by the dairy cows. Nearly all of the product from the cows is sold as fluid milk, and the fertilizer elements in it are therefore largely lost from the farms. On the other hand, most of the grain fed on these dairy farms in normal times comes from other regions. Based on authentic data for 1940, it has

The polka-dot effect of this pasture is caused by animal droppings, particularly urine.

been calculated by Professor B. A. Brown of the University of Connecticut that in the six New England States, for example, the phosphoric acid (P_2O_5) and potash (K_2O) in the grain fed exceed that in the milk produced by approximately 12 and 18 million pounds (25 and 50%) per year, respectively. Similar calculations result in an annual deficit of 24 million pounds of lime (CaO). Only a small part of the forage is sold as such and besides some hay is imported. In the light of these figures and facts, theoretically these dairy farmers should have to purchase lime only to maintain at least the present level of the major minerals in their soils. This should be true, particularly of the more intensive dairy farms. That this theory has failed in practice is illustrated by the phosphorus-starved condition of many permanent pastures and the common response of legumes to additional potash, even on the heavily manured meadows. The reasons for this situation appear to be due in large part to improper handling and distribution of manure, poor management of pastures, and the fact that the soils were originally low in available minerals and were further depleted by the selling of crops and animal products before the advent of the present intensive fluid milk period.

Assuming that these factors are the major causes for the obvious phosphorus and potassium deficiencies of our Northeast dairy farm soils, then over a long period a much better situation should result from the adoption of such practices as: (1) saving of all the urine excreted indoors, by means of tight gutters and sufficient absorbent, (2) storing the manure in water-tight pits and for as short a time as possible, (3) applying manure in smaller amounts over more acres, including the permanent pastures, and (4) controlling the grazing of pastures and the distribution of voidings by fencing pastures into smaller areas and rotating them for day and night use. Even on the very intensive farms the adoption of these methods, plus adequate lime, will not bring impoverished land to a high level of crop production in a short time.

From the evidence that has been presented, it would seem that the first step in increasing the effectiveness of plant food use on dairy farms would be to

add to the manure produced a liberal supply of phosphorus and on many farms, potash, the two elements most likely to be deficient and therefore needed. An effective way to supply superphosphate is to spread one to two pounds in the gutter each day for each cow. Since potash materials should not be used where they will come in contact with animals' feet for long periods of time, a practical means of supplying both phosphate and potash is to add from 50 to 75 pounds of superphosphate and about 25 pounds of muriate of potash for each spreader load of manure before hauling to the field. Such a practice has the advantage of increasing the amounts of phosphorus and potash, so that the treated manure contains the plant-food constituents more nearly in amounts required for the crops commonly grown.

Manure alone, even when adequately reinforced with phosphorus and potash, is seldom abundant enough to take care of the full plant-food needs of both crop land and pastures. For its most economical use, especially where corn is grown chiefly for silage, practically all of the manure produced should go on the land to be used for this crop. At the average annual rate of production of manure per cow, approximately 13 tons, it can readily be seen that there will be enough only for about one acre of corn for each cow, scarcely enough for the acreage of this crop normally required.

More and more the trend on dairy farms is toward a smaller acreage of such cultivated crops as corn and the more extensive use of grasses and legumes. Under these conditions, obviously there will not be enough manure to go around. Because of this, and because heavily manured pastures are invariably less palatable, its use should be restricted to moderate applications on land used for corn silage and the supplemental annual crops that may be required, and to an annual application of four to five tons per acre on as much of the permanent grassland acreage as possible. It will be necessary, therefore, that the major portion of the plant nutrients, particularly for the permanent grass and legume pasture, be supplied for these crops as commercial fertilizer.

Except on soils unsuited to the growing of pastures because of poor drainage or sandy or stony character, a system of fertilization that will supply an abundance of the necessary plant-food elements may be expected to increase the carrying capacity of pastures from 50 to as much as 100%. There are many dairy and livestock farms in the Northeast where pastures are so fertilized and managed as to provide the bulk of the feed requirements of the herd from May 1 to October 15. On such farms milk or other livestock products are produced much more cheaply and with much less labor than on the average farm where only about 2½ months of grazing can be counted on. Stretching the pasture period from the low average of 2½ to possibly 5½ or 6 months by proper fertilization and management has been found to be easily possible. Certainly it would appear that the development of practices that will make this possible constitutes the major problem in any sane, rational pasture program under Northeast conditions.

Research Points the Way

What fertilizers to use and the rates at which they should be applied to give the most economical returns of high-quality forage have been pretty accurately determined by the research men of the state agricultural experiment stations. The Dairy Research Farms that have been established in many states are demonstrating in a very practical way that research practices can be profitably applied. And too, the county agents and extension specialists are doing a fine job of taking the more practical research practices direct to the individual farms. The contributions of these men provide abundant ammunition to the dairy and other livestock farmers of the country for meeting their production goals.

Festive Philosophy

(*From page* 5)

WHEN I registered at the Harrington, the helpful clerk inquired solicitously if I had chartered a truck for the back haul. I was at a loss to know his meaning until he told me that if I intended to gather the right dope from the WFA, FDA, and what else there was, I would be super-laden with data, errata, and agenda, enough in sooth, he said, to start what might become a "free library" but hardly a circulating one. Recalling my own fling at sundry handouts in bygone times thereabouts, I went out and hired two trucks.

I hate to disappoint anyone, but let there be a dense veil and an opaque screen put between me and thee concerning details of my Capitol adventures. After paying goodly sums for those trucks and their excess burdens, and handing large fees to eye doctors and foot fixers, I find myself back home in no reforming mood. My stock of reform is run out.

The reason is that I came to give orders and got them instead. I never knew there were so many kinds of orders or enough digits and letters to classify them all. Even my erstwhile cronies of depression days seduced me with them. Whenever I assayed to explain some homeopathic point of view in ordinary Midwest lingo, they halted me, rang for a clerk or two, and told them to heap me up with historical, legal, philosophical, and metaphysical backgrounds, plus directives on dilemmas and orders of infinite length.

For one fleeting moment I imagined I'd made the grade. It was when I went into a huddle with some boys in the information division, lads of my ilk, open-faced, candid, creatures of my own known world. But even they were impotent. Asking for a final statement on a very critical emergency climax, I was told that it would take two weeks more because the lawyers had to rewrite what the economists muffed. But please leave them my address and hope for the best, they said.

So thinkses I to myself, here I am back in the old bailiwick, buffeted and baffled, with more bunions than brains. There is only one other spot where my talent may serve to uplift our American ideals and bring to pass the safe landing field in a slough of despond.

I cannot convince my erring brother and sister consumers that they are often chiselers and cheaters; nor can I make a dent in the rock-ribbed monolith of bureaucratic indifference. Hence, one place and only one remains for me to exercise my rare ability and practice my powers of persuasion. That is the rural region, the haunts of my humdrum existence, the section where everyone is a native patriot and a sacred unspoiled sacrificer. If there is any place where I can bid for votes and kiss the babies with relish and gusto, it is out where Maud Muller rakes the hay.

I TOLD myself not to promise them anything or give them anything, except the dickens. They like straight-shooting even if it nicks them, but wise politicos tell me that he who expects to gather ballots by cash dispensations is just going against the rural grain. You can't buy them off. They usually vote opposite to the direction from whence the bribe comes. It isn't right to say they bite the hand that feeds them. They just prefer to do their own grazing.

Being weary of reforming, I chose the pleasant fields of agriculture for my campaign because farmers have so little crying need for immediate reform of any kind, except in tiny driblets applied in a sugar-coated way.

To that end I might pick on some crazy croppers who drain their soil resources, to bleed this and coming generations, or allow their farms to help widen the delta of the Mississippi. But no doubt that sin rests with a minority. so you must talk about it in a plausible,

general way, and let the worst sinners write their own tickets, or else see the county agent.

Or, I could raise Ned with them about the frequent custom of competing for this and that fruit or fat in this or that market, using excise fees and state tariffs and sundry quarrelsome debates to outlaw and outguess the other producers.

BUT I know full well that farmers find themselves at the year's end with plenty of problems and great responsibilities. Most of their worst problems and vexations are hardly of their own making, as a rule. So you can't go out before them with dizzy and dazzling demands and get away with it. If there's a spot where a stump speaker's feet must reach clear to the solid ground, it's when he tours for rural support.

Naturally, they are human and detest a reformer who raves about improvements, unless those correctives are to be applied to labor unions or bloated capitalists. Yet they are not entirely prejudiced about reform either. Their idea is that every man should be his own reformer, and administer his own medicine himself in doses that won't keep him off feed too long at a time. In many years of contact with rural minds I have observed many of them take a hint unobtrusively and then go out on the sly in the barn or back pasture and put that new idea to work without broadcasting it in a revival meeting. They are smart men, and you don't have to label the bottle when you pass it around.

It's nice for candidates like myself, too, because farm folks can swallow advice given offhanded that way without getting hopping mad and refusing to let you finish the roast chicken. You just leave with kind remarks about the weather and let the reform germs sizzle automatically.

So I close my announcement of ambitions with a small message delivered in "parable" form. Ever since the original parables were spoken to country folks, it's been the kindest and smoothest way to get over a tough situation and make rural communities see their relation to the national turmoil. So here is my only campaign speech, let it go for what it's worth on the above indirect system:

Suppose you are the manager of a big ranch and over in the next community a cattle stampede breaks loose, led by a couple of mad bulls, and they send over posthaste for you to send help pronto. So you dispatch your best bull wranglers and lariat tossers with enough guns, grub, and horses you think will do the trick.

Meanwhile the rest of the ranch hands suddenly decide to join the miners' union if you don't hike their wages before night, and the family begins to scrap with the kitchen help, upsetting the stove and busting out a fire.

Just then a phone call comes from the stampede zone that more critters have broke into a ruction and they need more men, gear, and Gatling guns to keep the animals from devastating the countryside. As you get set to issue orders and agree to anything so as to keep manpower going in the direction of the fracas, a cyclone cloud hoves in sight on the horizon and the storm cellar caves in.

LET this ranch boss represent the President of the United States under conditions and circumstances too evident to mention. And yet they say there's quite a few folks eager and willing to take over his job and do it better! Kinda funny, isn't it?

With this sentiment plus the usual holiday felicitations and remembrances to all my constant friends, I bow back off the platform, still unable to determine what to run for.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
UU-9 Oregon Beets and Celery Need Boron
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
A-1-41 Better Pastures in North Alabama
E-2-41 Use Boron and Potash for Better Alfalfa
K-4-41 The Nutrition of Muck Crops
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
G-3-42 More Legumes for Ontario Mean More Cheese for Britain
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
Z-8-42 The One-Mule Farmer Needs a New Machine
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
EE-11-42 Lespedeza Pastures for Florida
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
B-1-43 Crotalaria—A Crop That Grows Like Weeds
C-1-43 Quality in Grasses for Pasture and Hay
D-1-43 For Hershey Orchards—Complete Fertilizer
E-1-43 Borax for Alfalfa in Tennessee
F-1-43 Boron Improves Canning Beets
G-1-43 Plow-Sole Fertilizers Make Good Showing
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
K-2-43 Feeding Minerals By Way of the Soil
L-2-43 Victory Gardeners Produce & Preserve
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
O-3-43 Indirect Nitrogen Fertilization
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
Q-3-43 Winning the Battle for the Land
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
T-4-43 Fertilizing Tung Trees by Leaf Analysis
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
Z-5-43 Poultry Manure—Source of Nitrogen
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
DD-6-43 Salt With Potash for Some Crops
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
GG-8-43 Why Do Farmers Plow?
HH-8-43 More Soybeans, Please!
II-10-43 Soil Conservation in Puerto Rico
JJ-10-43 Soil Management for Field Beans
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STOPPED

A young preacher came to one of the distant settlements, and started to reform the natives. Among other things to which he objected was smoking by women. He stopped one day at old Nancy's cabin and found her enjoying an after-dinner smoke on her corncob pipe.

"Aunt Nancy," he said, "when your time comes to go, and you apply for admission at the gate of Heaven, do you expect St. Peter will let you in if he detects the odor of tobacco on your breath?"

"Young man, when I go to Heaven, I expect to leave my breath behind."

"Every man's ambition is to marry a good cook, a witty companion, a skillful housekeeper and a devoted wife," declares a writer. Yes, men are naturally polygamous.

HOMESPUN

Mountaineer: "Listen, woman, who's wearin' th' pants 'round here, anyhow?"

His Wife: "Joe's wearin' 'em today, Paw. You'all will have ter stay in th' cabin."

"As I understand the case," said his honor, "you and your husband had an altercation and you were kicked in the ensuing rumpus."

"No, sah, Jedge," replied Mandy. "Ah was kicked in de stummick."

"Mamma, how do you get the cubic contents of a barrel?"

"I don't know. Ask your father."

Gob: "Am I the only man who ever kissed you?"

Girl: "Why will every man ask the same question?"—*U. S. S. Nevada Cheer-Up.*

Small Niece: "Boys is awful coarse, isn't they?"

Aunty: "Why do you think so?"

Small Niece: "Bobby calls his new coat a 'sweater' stead of a perspiratioher."

GOB HUMOR

'Twas just the other evening,
In a fortune-telling place,
A pretty gypsy read his mind
And then she slapped his face!

—*U. S. Coast Guard Magazine.*

Speaker—"I have lived in this town all my life. By actual count there are fifty-five taprooms and saloons in the town, and I am proud to say I have never been in one of them."

Voice—"Which one is that?"

"If you refuse me, Irma, I shall never love another."

"That last part is Oke with me, but what I want to know is, will it hold good if I accept you?"

Advice is the counsel old men give young men when they can no longer set them a bad example.

He: "I'm not feeling myself tonight."

She: "You're telling me!"

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- Potash Deficiency in Grapes and Prunes
- New Soils from Old
- Potash Production in America

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POTASH IN NORTH AMERICA

By J. W. TURRENTINE

President American Potash Institute

AMERICAN CHEMICAL SOCIETY MONOGRAPH NO. 91

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AMONG American chemical industries that have attracted national and international attention due to their war-emergency performance, few have exceeded the American potash industry.

This interesting and well-written survey of the development of the American potash industry during the last fifteen years is particularly important at the present time, when the food problem is second in importance only to the war itself. After a brief review of the present sources of potash, complete details are given as to production, both domestic and foreign; present status of the industry; and its future prospects. Special attention is accorded to Carlsbad, N. M., and Searles Lake, Calif., developments, and to the fundamental technology of potash. This important volume has been made unusually attractive by the inclusion of a large number of exceptionally good photographs of all phases of the industry.

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